NUCLEAR SCIENCE ABSTRACTS

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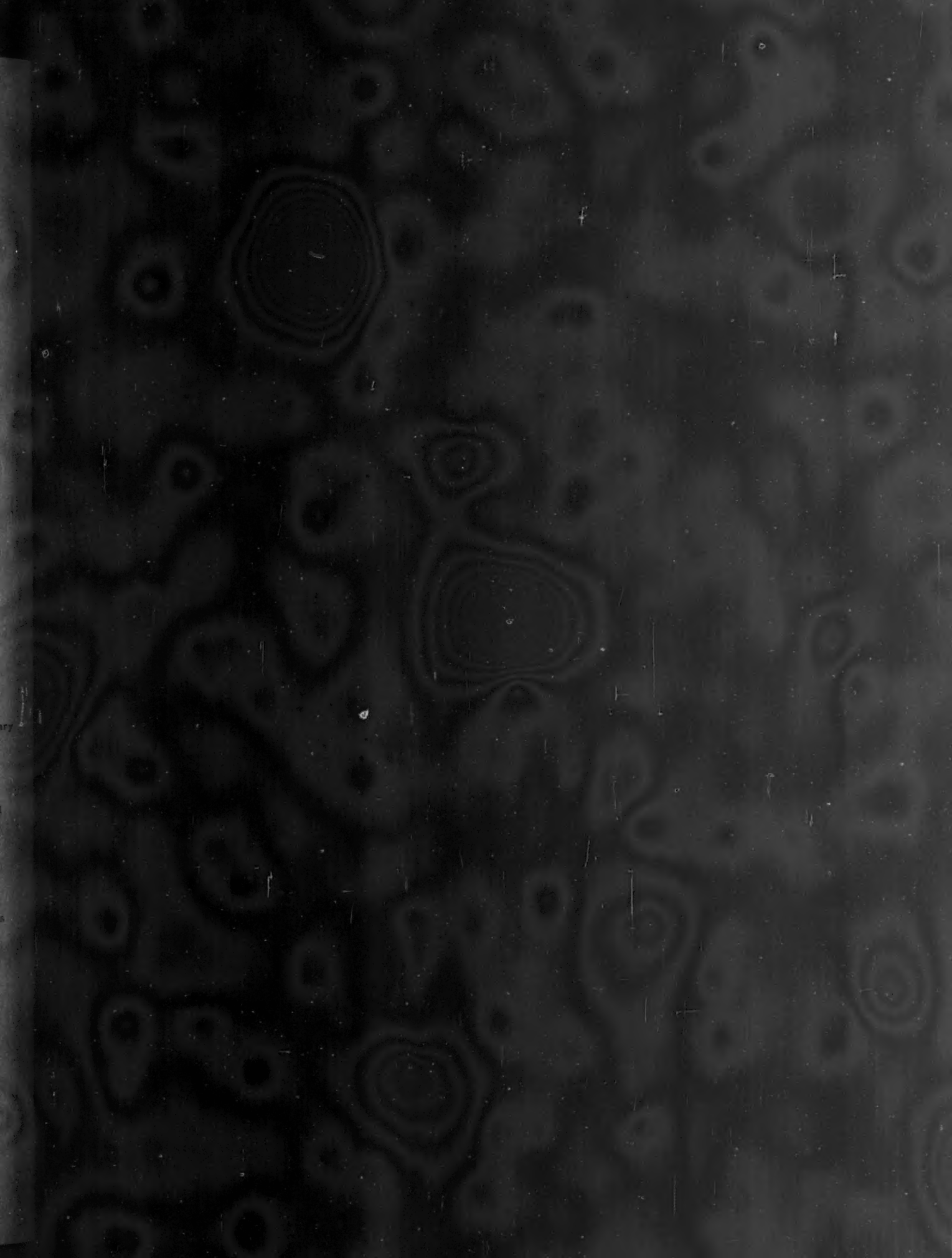

NUCLEAR SCIENCE ABSTRACTS

A Publication of the United States Atomic Energy Commission Technical Information Service.

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Nuclear Science Abstracts (NSA) is intended to serve scientists and engineers working in the field of atomic energy by abstracting as completely and as promptly as possible the literature of nuclear science and engineering. It covers not only unclassified and declassified research reports of the U. S. Atomic Energy Commission and its contractors, but also material that appears in research reports of other U. S. and foreign government agencies, universities, and industrial research organizations and in the technical and scientific journals.

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The printing of this publication has been approved by the Director of the Bureau of the Budget, July 30, 1957.

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ERRATA

NSA Vol. 12, No. 4, p. 358. In abstract 3183, R. P. Strivastav should be R. P. Srivastav.

NSA Vol. 12, No. 6, p. 515. In abstract 4587, N. J. C. Bohlin should be N. J. G. Bohlin.

NSA Vol. 12, No. 10, p. 779. In abstract 6878, Max Hoyauz should be Max Hoyaux.

NSA Vol. 12, No. 10, p. 735. In abstract 6490, E. E. Peterson should be E. E. Petersen.

NSA Vol. 12, No. 10, p. 790. In abstract 6975, J. C. Charlton should be J. C. Chalton.

NSA Vol. 12, No. 11, p. 808. In abstract 7129, M. V. Tovin should be M. B. Tovin.

NSA Vol. 12, No. 11, p. 824. In abstract 7249, K. G. Kinashova should be K. G. Kunashova.

NSA Vol. 12, No. 11, p. 838. In abstract 7360, Ye. P. Pzhigov should be Ye. P. Ozhigov.

NSA Vol. 12, No. 11, p. 843. In abstract 7413, J. Guant should be J. Gaunt.

NSA Vol. 12, No. 11, p. 847. In abstract 7465, N. R. Scheve should be M. R. Scheve.

NSA Vol. 12, No. 12A, p. 892. In abstract 7849, F. L. Schubert should be F. L. Shubert.

NUCLEAR SCIENCE ABSTRACTS

Volume 12 Number 22 November 30, 1958

GENERAL

16074

DOCUMENTATION IN THE FIELD OF ATOMIC ENERGY. E. Pietsch. Atomwirtschaft 3, 351-3(1958) Aug.-Sept. (In German)

The creation of a central control for the documentation of information in the field of atomic energy in the German Federal Republic is described. The clearing house is based on procedures established abroad, mainly in the USA. (J.S.R.)

Atomic Bombs and Warfare

16075 WT-1461

Food and Drug Administration, Washington, D. C. and Federal Civil Defense Administration, Battle Creek, Mich.

BLAST EFFECTS ON GLASS VACUUM CONTAINERS. Edwin P. Laug and Harold V. Leininger. Mar. 1958. 12p. Project 38.1-11 [of] OPERATION PLUMBBOB. $0.50(OTS).

Case lots of Federal Civil Defense Administration perfusion and blood-collecting bottles were exposed to a nuclear explosion of approximately twice nominal yield. The bottles, packed six to a paperboard carton, were exposed in trenches ¼ and ½ mile from Ground Zero (GZ). There was 40% failure in the 1000-ml perfusion bottles with limited evacuated head space and 23% failure in those bottles with the vacuum relieved before exposure. There were no failures in the blood-collecting bottles containing 120 ml of fluid with 600 ml of evacuated head space. Greatest failure in the 1000-ml perfusion bottles occurred in the cartons placed on their sides with the tops facing GZ. Sterility and pyrogen tests of the bottle contents indicated that there were no hidden failures in any bottle seals. (auth)

16076

SEISMIC RECORDINGS OF NUCLEAR EXPLOSIONS. Yvonne Labrouste. Compt. rend. 247, 321-3(1958) July 21. (In French)

Seismic recordings of nuclear explosions allow the geographic coördinates to be determined to within 10 km. The observations also permit the duration of the propagation of the seismic wave to be measured. (tr-auth)

16077

SEISMIC SURFACE WAVES AT PALISADES FROM EXPLOSIONS IN NEVADA AND THE MARSHALL ISLANDS. Jack Oliver and Maurice Ewing (Columbia Univ., New York). Proc. Natl. Acad. Sci. U. S. 44, 780-5(1958) Aug.

Surface waves from large nuclear explosions in the Marshall Islands were detected at Palisades, New York, at a distance of about 105° and presumably may be detected by long-period seismographs throughout the world. Surface waves from nuclear explosions in Nevada were detected at Palisades at a distance of about 33° and presumably could be detected throughout most of North America. No information is available on these waves for oceanic paths. Signals from both sites consist entirely of dispersed Rayleigh wave trains. The dispersive pattern may be explained by using dispersion curves developed in studies of earthquake-generated surface waves. No Love or body waves were detected at Palisades. All the foregoing data are for sources on or above the earth's surface. Rainier, the small underground nuclear explosion, was not detected at Palisades. (auth)

16078

THE PHYSICS OF NUCLEAR EXPLOSIONS AND THE EFFECTS OF NUCLEAR WEAPONS. II. Rudolf Schrader. Naturw. Rundschau 11, 299-306(1958) Aug. (In German)

The effects of nuclear weapons are discussed in this second part. The energy distribution of a nuclear explosion is discernible by the pressure, thermal, and radiological effects. These effects are discussed with respect to an air explosion. Radiation danger and protection are also discussed. (J.S.R.)

Atomic Power

16079 AECU-3664

Stanford Research Inst., Menlo Park, Calif.

PROCESS HEAT GENERATION AND CONSUMPTION, 1939 TO 1967. W. Lawrence Prehn, Jr., and Richard R. Tarrice. Jan. 1958. 102p. SRI Project No. IU-2169. Contract AT(04-3)-115, Project III.

A survey and analysis of the generation and use of heat in manufacturing has been completed. The greatest emphasis has been placed on the variety of heat applications in United States manufacturing industries with some discussion of other important uses. The generation of electricity is excluded from this analysis. The generation of heat through steam production and through direct-firing means is analyzed and described in terms of the major economic factors dictating application and possible growth. These factors include: geography, fuel, industry growth, cost, heat quality, generating unit size, and other contributing elements. Some data are given on similar matters in foreign countries. Only those countries which are important in terms of industrial activity are considered. A projection of demand for industrial heat in the categories studied is shown for the next five years and the next ten years. It is concluded that certain portions of the industrial complex of the world are sufficiently important in terms of the use of heat that further detailed study of the above factors is well justified. (auth)

16080 JPRS-51
PROSPECTS OF THE ECONOMY OF ATOMIC POWER. H. F. Mueller. Translated from Voprosy Yadernoi Energetiki, No. 2, 3-21(1957). 37p.

The world power supplies are reviewed and conclusions advanced as to how long they can be expected to last. Various types of nuclear power plants are compared as to efficiency and costs. A conventional steam power plant is compared to a nuclear power plant in terms of initial cost and fuel cost. (W.D.M.)

16081
THE INDUSTRIAL USE OF RADIOACTIVE MATERIALS. K. Hogrebe. Atomwirtschaft 3, 311-13(1958) Aug.-Sept. (In German)

The present state of development in the industrial use of radioactive materials and the progress made from 1955 to 1958 in the German Federal Republic are described. The annual turnover of radioisotopes increased from 372,000 to 682,000 DM during this period, although, as yet, there is no domestic production. Of the total of 510 users, there were 210 medical, 160 industrial, and 140 research institutes in 1957. (J.S.R.)

16082
THE DEVELOPMENT OF ATOMIC LAW. H. Fischerhof. Atomwirtschaft 3, 329-30(1958) Aug.-Sept. (In German)

Since a uniform federal statute has not been passed in the German Federal Republic, the development of atomic law has centered around the formation of the Federal Ministry for Atomic Affairs, appeal to the German Commission, and the enactment of temporary laws in several of the states. (J.S.R.)

Research Programs

16083 PB-141351-T
ARTIFICIAL SATELLITES. Second Revised and Extended Edition. (Iskusstvennyye Sputniki.) A Shternfel'd. Translated for Wright-Patterson Air Force Base, Ohio from a publication of the State Publishing House of Technical-Theoretical Literature, Moscow, 1958. 434p. (F-TS-9570/V). $6.00(OTS).

The methods of launching artificial satellites, their availability for scientific purposes and as interplanetary stations, and the expected conditions of life on such satellites are presented. Major emphasis is placed on questions of celestial mechanics and rocketry with secondary consideration of questions such as remote control, radio communications, and physiology, including information which has already been published. (J.R.D.)

16084
PHYSICS RESEARCH AT HARWELL. B. F. J. Schonland (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Brit. Nuclear Energy Conf. 3, 166-9(1958) July.

A summary of present activities and plans for future efforts at Harwell is presented. The functions at Harwell are to obtain basic knowledge and pursue new ideas. In reactor development, only the feasibility of any design is determined, leaving the final prototype design to others. A general discussion of atomic fission is presented, pointing to the difficulties in reactor control and removal of poisons, along with a discussion of methods for determining capture cross sections and other nuclear constants. A final discussion of fusion is presented. (J.R.D.)

BIOLOGY AND MEDICINE

16085
RADIOELEMENT DISTRIBUTION IN SKELETAL TISSUE. J. Jowsey (Argonne National Lab., Lemont, Ill.). Atompraxis 4, 291-4(1958).

The literature concerned with the characteristic distribution in the skeleton of bone seeking radioisotopes is briefly reviewed, and the use of isotopes in bone metabolic studies is discussed. (auth)

16086
STAINING OF TISSUE SECTIONS FOR ELECTRON MICROSCOPY WITH HEAVY METALS. Michael L. Watson (Univ. of Rochester School of Medicine and Dentistry, N. Y.). J. Biophys. Biochem. Cytol. 4, 475-8 (1958) July 25.

Heavy metals may be incorporated from solution into tissue sections for electron microscopy. The resulting increase in density of the tissue provides greatly enhanced contrast with minimal distortion. Relative densities of various structures are found to depend on the heavy metal ions present and on the conditions of staining. Certain hitherto unobserved details are revealed and some sort of specificity exists, although the factors involved are not yet understood. (auth)

16087
DEVELOPMENT AND PRESENT STATE OF HYPOTHESIS FORMATION IN QUANTITATIVE RADIATION BIOLOGY. K. G. Zimmer (Univ. of Heidelberg and Institut für Strahlenbiologie an der Reaktorstation, Karlsruhe, Germany). Naturwissenschaften 45, 325-7 (1958). (In German)

A review is presented of the development and present state of hypothesis formation in quantitative radiation biology. 32 references. (J.S.R.)

Radiation Effects

16088 AEC-tr-3340
EMBRYO MORTALITY AMONG THE PROGENY OF MALE DROSOPHILA FLIES FOLLOWING IRRADIATION WITH 180 kev AND 31 Mev. Rolf Steger. Translated for Los Alamos Scientific Lab. from Oncologia 9, 12-32(1956). 16p.

A quantitative study was made of the effectiveness of x radiation produced by 180 kev and 31 Mev sources for inducing the occurrence of dominant lethal factors in the sex cells of male Drosophila. Following exposure to various radiation doses the male Drosophila were mated with previously unmated females and a count made of the ratio of hatched to unhatched eggs which resulted. A total of 94,389 eggs were counted. It is suggested that the enormous increase of unhatched eggs between days 6 and 12 may not have resulted from lethal factors, but to azoospermia induced by radiation. The 31 Mev betatron was shown to be only 0.8 times as effective as the stable voltage generator in producing dominant lethal factors. (C.H.)

16089 AEC-tr-3366
A COMPARISON OF THE EFFECT OF 31 MEV AND 180 KEV X-RAYS ON THE MITOSIS OF VICIA FABA L. Hedi Fritz-Niggli. Translated from Oncologia 9, 269 (1956). 8p.

The biological effects of 31-Mev and 180-kev x radiation were compared on mitosis in root tips of Vicia. Radiation damage appeared earliest in the transition of metaphase to anaphase. Both types of x radiation in-

duced a decrease in the number of cells in the anaphase. No difference was noted in the effects of x rays from the 31 Mev betatron and a 180 kev generator. (C.H.)

16090 AEC-tr-3367

COMPARATIVE EFFECTS OF ROENTGEN RAYS PRODUCED BY THE 180 KEV AND THE 31 MEV GENERATORS ON THE EHRLICH ASCITES TUMOR OF WHITE MICE. Kurt Reiche. Translated from Strahlentherapie 97, 549-67(1955). 17p.

The biological effects of 31-Mev and 180-kev x radiation were compared by observing the effects on mitosis in specimens of mouse Ehrlich ascites tumor. The morphology of non-irradiated cells and methods used in preparing the specimen for cytological examination are described. Study of cells from irradiated animals revealed no mitotic form not previously observed in the normal mitotic figures, however, 24 hours after exposure to either 180-kev or 31-Mev x radiation the number of polyploid metaphases had approximately doubled and the number of polyesters in the telophase appeared to have increased by a factor of four. An increase was also noted in the number of metaphases after 48 hours. No statistically significant differences were noted in the biological effects of 180-kev and 31-Mev x radiation. (C.H.)

16091 NP-tr-145

THE EFFECT OF VARIOUS APPLICATIONS OF X-RAYS ON BONE MARROW AND ITS CELL ELEMENTS INCLUDING A CONTRIBUTION TO THE TIME FACTOR PROBLEM. Robert Bauer. Translated for U.K.A.E.A. Atomic Energy Research Establishment from Strahlentherapie 67, 487-99(1940). 10p.

Data are presented from a study of the sensitivity of rabbit bone marrow to various doses and various time distributions of the dose of x radiation. Results are compared with observations on the radiosensitivity of the skin and hematopoietic system. (C.H.)

16092

MID-LINE TISSUE DOSE AND LETHALITY IN X-IRRADIATED RATS. J. G. Kereiakes (U. S. Army Medical Research Lab., Fort Knox, Ky.). Am. J. Physiol. 194, 316-18(1958) Aug.

The LD_{50} values were determined for rats exposed to 100 to 250 kvp x rays for doses expressed in air and in tissue. Dose measurements were made in animal tissue. For the LD_{50} tissue doses, the relative effectiveness was approximately one for all qualities. For the experimental conditions of the study, it seems that mid-line tissue dose may be the proper parameter for acute lethality in rats exposed to x radiations having different depth dose distributions. (auth)

16093

IRRADIATION OF THE GASTROINTESTINAL TRACT OF THE RAT BY INGESTED RUTHENIUM-106. Roy C. Thompson and O. L. Hollis (General Electric Co., Richland, Wash.). Am. J. Physiol. 194, 308-12(1958) Aug.

Rats were killed at intervals from 35 minutes to 30 hours following intragastric administration of a solution of Ru^{106} chloride. Distribution of Ru^{106} within the various segments of the gastrointestinal track, and distribution of tract contents were determined. Results are interpreted in terms of the rate of passage of material through the gastrointestinal tract, and the resulting radiation dose to the various segments of the tract. The largest radiation dose is delivered to the lower large intestine. Doses to other segments of the tract are lower by as much as a factor of five. There appears to be no significant hold-up of the radioisotope due to absorption on the intestinal wall. (auth)

16094

EFFECT OF LARGE DOSES OF HEAD IRRADIATION IN DOGS. Ming-Tsung Peng, Shu Chien, and Magnus I. Gregersen (Columbia Univ., New York). Am. J. Physiol. 194, 344-50(1958) Aug.

Dogs in which the head was x-irradiated with 23,500 r survived from 14 to 28 hours. The chief neurological signs were disturbance of equilibrium and extensor rigidity. Throughout the whole postirradiation course, the blood volume showed very little change. Arterial pressure, heart rate and respiratory rate remained essentially unchanged until about 1 hour before death. The carotid sinus reflex did not change until 30 to 60 minutes before death, but then deteriorated rapidly. Generally, the respiratory response to cyanide injection was still present after the disappearance of the carotid sinus reflex. At the terminal stage, the pressor response of the medullary vasomotor center to electrical stimulation decreased in parallel to that of the carotid sinus reflex. The vital centers in the medulla oblongata are directly damaged by large doses of x-irradiation. The failure of respiration is the cause of death. (auth)

16095

COMPARISONS OF THE BIOLOGICAL EFFECTS OF IONIZING RADIATIONS AND CERTAIN ALKYLATING AGENTS IN CELL SYSTEMS. E. L. Powers and J. H. Pomeroy (Argonne National Lab., Lemont, Ill.). Ann. N. Y. Acad. Sci. 68, 702-20(1958) Apr. 24.

A review is presented of studies in which the effects of alkylating agents are compared with effects of ionizing radiation. (C.H.)

16096

RADIOCARBON FROM NUCLEAR TESTS AND «NON-THRESHOLD» EFFECTS OF ATOMIC RADIATIONS. A. D. Sakharov. Atomnaya Energ. 4, 576-80(1958). (In Russian)

The effects of radiocarbon from nuclear tests on heredity and genetics in humans are discussed. (R.V.J.)

16097

THE EFFECT OF X-IRRADIATION ON THE SYNTHESIS OF PROTEIN IN THE SHOOTS OF RYE. N. M. Sisakian and V. Y. Kalacheva (Bach Inst. of Biochemistry, Academy of Sciences of the USSR, Moscow). Biophysics (USSR) (English Translation) 4, 471-4(1958).

During the first four hours after the exposure of ten-day rye seedlings to 5000 r of x radiation an activation of protein synthesis was noted. During the next twenty-four hour period the rate of protein synthesis decreased to the level of the control. A dose of 10,000 r resulted in an immediate 15 to 25% decrease in protein synthesis. This inhibition increased with time and in 24 hours reached 75%. Glycine labeled with carbon-14 was employed in the studies. (C.H.)

16098

THE COMBINED ACTION OF ULTRA-VIOLET AND X-RAYS ON THE SPORES OF BACILLUS ANTHRACIS. E. N. Sokurova and M. N. Meisel' (Inst. of Microbiology, Academy of Sciences of the USSR, Moscow). Biophysics (USSR) (English Translation) 4, 474-7(1958).

Ultraviolet radiation combined with x radiation proved more effective than either type of radiation alone for the inactivation of the spores of Bacillus anthracis. (C.H.)

16099

TIME DISTRIBUTION OF MORTALITY IN IRRADIATED ANIMALS. N. V. Luchnik (Biological Inst., Urals Branch, Academy of Sciences of the USSR, Sverdlovsk). Biophysics (USSR) English Translation 4, 477-84(1958).

At doses in the order of $LD_{50/30}$ up to five mortality

peaks were observed in irradiated mice during the 20 days immediately following exposure. An attempt is made to relate the mortality peaks to various terminal causes of death in irradiated animals. (C.H.)

16100

PRIMARY AND SECONDARY LESIONS IN THE BONE MARROWS OF X-IRRADIATED ANIMALS. V. A. Sondak (Inst. of Biophysics, Academy of Sciences of the USSR, Moscow). Biophysics (USSR) (English Translation) 4, 485-91(1958).

Luminescence microscopic and histologic methods were employed in studies of the early reactions to irradiation in the bone marrow of rats and mice. To reveal the direct effect of radiation on bone marrow, a site was irradiated locally while the rest of the body was screened. The animals were decapitated at intervals from 18 sec to 24 hours after irradiation. Morphological changes and impairment of nucleic acid metabolism in the nuclei and cytoplasm of cells in irradiated areas of bone marrow were found 30 seconds after irradiation. Dose response data are included. (C.H.)

16101

SOME DEVELOPMENTAL REGULARITIES IN THE PROGENY OF FEMALES γ-RAY IRRADIATED DURING PREGNANCY. E. G. Lomovskaya and E. I. Vorob'eva Lomonosov State Univ., Moscow). Biophysics (USSR) (English Translation) 4, 492-501(1958).

A study was made of the effects of the irradiation of female mice at various stages of pregnancy on the postnatal development of the offspring. The data show that the time of irradiation had a marked effect on both foetal and post-natal development. Data are tabulated. (C.H.)

16102

THE ACUTE EFFECTS OF PARTIAL-BODY BETA IRRADIATION OF MICE. J. C. Crook, E. V. Hulse, J. H. Mulvey, and G. J. Neary (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Brit. J. Radiol. 31, 477-85(1958) Sept.

An apparatus for the partial-body β irradiation of mice using Sr^{90} is described. Two groups of mice, hairless and CBA, were irradiated over one, two or three zones with a range of surface dose from 3000 to 24,000 rads. As well as the expected burns of the skin, lesions of the intestine also occurred. Both types of damage are described and their killing effects discussed. No worthwhile LD_{50} values for skin burns could be obtained due to the interaction of these two lesions. The skin burns of the hairless mice developed sooner and produced a greater mortality than those of the CBA mice and the possible explanations for this are discussed. (auth)

16103

THE EFFECTS OF CHEMOTHERAPY AND IRRADIATION THERAPY ON THE DIFFERENTIATION OF EXPERIMENTAL TUMORS. Nathan B. Friedman and Eileen Drutz (Cedars of Lebanon Hospital and Univ. of Southern California, Los Angeles). Cancer 11, 1060-9 (1958) Sept.-Oct.

Several transplantable tumors in mice were irradiated or treated with chemotherapeutic agents. The increased size of the cells that accompanied the mitotic inhibition produced by irradiation or nitrogen mustard was considered due to continued synthesis of cytoplasmic protein despite inhibition of premitotic synthesis of nuclear material. It was possible to demonstrate increased differentiation of the irradiated neoplastic elements, manifested as increased keratinization in two epidermoid carcinomas and as increased pigmentation in a melanoma. Colchicine, on the other hand, interfered not only with cytoplasmic growth but with differentiation, as reflected in alterations in the production of melanin. Although cell division was also inhibited by colchicine, the formation of nuclear material continued. Study of Feulgen and toluidine blue O stains and of fluorescent acridine orange NO preparations revealed increased ribonucleic acid (RNA) but decreased deoxyribonucleic acid (DNA) in neoplastic elements exposed to nitrogen mustard and decreased RNA but increased DNA in cells treated with colchicine. It is suggested that the differentiation of cells is related to the synthesis of RNA. Since either DNA or RNA synthesis can be selectively affected, those agents that affect RNA inhibit differentiation, while those that attack primarily DNA permit differentiation to continue. (auth)

16104

RADIATION AND THE HUMAN RACE. Shields Warren (New England Deaconess Hospital, Boston). Conn. State Med. J. 22, No. 6, 451-7(1958) June.

The beneficial results of natural radiation are pointed out. Artificial sources of radiation are discussed, particularly radioactive fallout such as occurs at testing areas and such as resulted from the bomb explosions in Japan in World War II. The ordinary therapeutic use of radiation is not harmful but if applied in certain unusual ways it may be harmful. In dealing with the present controversy between radiologist and biologist, an important fact to remember is whether the radiation is delivered acutely or chronically. The amount, the manner of reception, and the kind of radiation are important. (auth)

16105

ON THE NATURE OF THE DESTRUCTIVE PROCESSES TAKING PLACE IN THE SPLEEN OF MICE AS A RESULT OF EXPOSURE TO X-RAYS. N. F. Barakina (Severtsov Inst. of Animal Morphology, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 121, 631-3(1958) Aug. 1. (In Russian)

Effects of ionizing radiation on the cumulative changes in organisms were studied in order to determine the destructive changes in organs after direct and indirect exposures. Experiments were made with white mice weighing 18 to 20 g, one group of which was exposed to total-body irradiation, the second group exposed with a partial or complete screening of the spleen, and the third group with completely screened body with partial or complete exposure of the spleen. Following the third day of exposure, the morphological changes in the spleen were similar in total-body or spleen-only exposure. A reverse picture was observed in total-body exposure with shielded spleen—no destruction of cells was observed in the spleen or in the shielded portion of it. The similarity of spleen changes in total and local irradiation and absence of any changes in the shielded portions indicate that mass cell destruction results from direct irradiation. However, the restorative processes are different in instances of local spleen exposure; the restoration takes place earlier than in the case of total body exposure. (R.V.J.)

16106

THE INFLUENCE PRODUCED BY IRRADIATION UPON CERTAIN ENZYMES LOCALIZED IN THE STRUCTURES OF LAMELLAR BODIES OF THE MESENTERY IN CATS. L. A. Afrikanova. Doklady Akad. Nauk S.S.S.R. 121, 834-6(1958) Aug. 11. (In Russian)

The effects of local irradiation on the lamellar bodies of the mesentery in cats were studied in order to determine the early changes in the receptors. The

lamellar bodies belong to the type of non-capsular sensitive peripheral nerve endings and function as baroreceptors. (R.V.J.)

16107

REACTIVE VARIATIONS IN THE NERVE ELEMENTS OF THE MALE GONAD OBSERVED IN MAMMALS EXPOSED TO THE EFFECT OF X-RAYS. A. M. Rastvorova (Pavlov Ryazan Medical Inst.). Doklady Akad. Nauk S.S.S.R. 121, 841-4(1958) Aug. 11. (In Russian)

The experimental data show that the nerve elements in the male gonads of mammals are sensitive to penetrating x radiation. Because of the varying radiosensitivity of the nerve fibers, the radioinduced changes vary accordingly. The strongest resistance to radiation effects was found in the nerve appendices of the male gonad glands. (R.V.J.)

16108

RADIATION PROCESSING OF FOODS. A COMMENTARY ON PRESENT RESEARCH. R. S. Hannan and Margaret J. Thornley (Univ. of Cambridge, Eng. and Dept. of Scientific and Industrial Research). Food Manuf. 7p.(1957) Oct.-Dec.

The status is reviewed of research in Great Britain in 1957 on the radiation processing of foods. (C.H.)

16109

HISTOLOGICAL CHANGES IN TUMOR TISSUE INDUCED BY IONISING RADIATION. 1. ANIMAL EXPERIMENT. Kempo Tsukamoto and Toshio Kitagawa. Gann 49, 1-4(1958) Mar.

The latent period between exposure and lethal radiation effects was established as three weeks for the Yoshida sarcoma in rats. (C.H.)

16110

HISTOLOGICAL CHANGES IN TUMOR TISSUE INDUCED BY IONISING RADIATION. 2. CLINICAL EXPERIMENT. Kempo Tsukamoto and Toshio Kitagawa. Gann 49, 5-8(1958) Mar.

A wide variety of cancer was treated by various methods of irradiation. Biopsies were taken before, during, and after irradiation. Histological examination of the tumor sections indicate that there is a latent period of about three weeks between irradiation and recurrence of growth of tumor cells. (C.H.)

16111

OBSERVATIONS ON THE MICROFLORA OF MINCED CHICKEN MEAT IRRADIATED WITH 4 Mev CATHODE RAYS. Margaret J. Thornley (Univ. of Cambridge, Eng. and Dept. of Scientific and Industrial Research). J. Appl. Bacteriol. 20, 286-98(1957) Aug.

Results are reported from experiments in which minced chicken meat, packed anaerobically, was irradiated at room temperature and in the frozen state with a wide range of doses of 4 Mev cathode rays. (C.H.)

16112

RESPONSE OF POTASSIUM RETENTIVITY AND SURVIVAL OF YEAST TO FAR-ULTRAVIOLET, NEAR-ULTRAVIOLET AND VISIBLE AND X-RADIATION. A. K. Bruce (Oak Ridge National Lab., Tenn.). J. Gen. Physiol. 41, No. 4, 693-702(1958) Mar. 20.

Potassium retentivity and survival of yeast were studied after exposure to various kinds and conditions of irradiation. (C.H.)

16113

STUDIES WITH TRANSPLANTABLE AK^4 MOUSE LEUKEMIA. III. EFFECT OF SPLEEN AND MARROW SHIELDING ON AK^4 LEUKEMIC IMPLANTS IN HOMOLOGOUS STRAINS OF IRRADIATED MICE. Irene U. Boone, Betty S. Rogers, and Payne S. Harris (Los Alamos Scientific Lab., N. Mex.). J. Natl. Cancer Inst. 21, 513-22(1958) Sept.

Alterations in the susceptibility of homologous strains of x-irradiated mice to AK4 leukemic implants by spleen and femur shielding at the time of whole-body irradiation was determined in the A/St and C57BL strains of mice. The protective effect of spleen or femur shielding in irradiated animals that did not receive leukemia was also evaluated in these strains. The results of the experiments with irradiated animals that did not receive leukemia indicated that, although a protective effect was produced by either spleen or femur shielding in both strains, there were no significant quantitative differences afforded by the tissue shielded in either strain. Resistance to transplantable leukemia was partially protected by femur shielding in the irradiated A/St and C57BL mice and by spleen shielding in the irradiated A/St mice. However, in the irradiated C57BL animals that received leukemia, there was no significant difference between the spleen-shielded and nonshielded groups. The differences in the spleen-shielding results between the A/St and C57BL mice tend to indicate that greater protection was associated with myelopoietic tissue than with lymphoid tissue. (auth)

16114

USE OF γ-RADIATION FOR PREVENTING THE SPROUTING OF POTATOES. W. G. Burton and R. S. Hannan. J. Sci. Food Agr. No. 12, 707-15(1957) Dec.

Gamma irradiation at doses as low as 3500 r suppresses the sprouting of potatoes, but it may also have harmful effects. After storage for 6 months or more, sweetening rendered the tubers unsuitable for crisp or chip production. After 15 months, a great accumulation of sugar and complete breakdown were observed. Irradiation at 20,500 r and over increased the initial rate of water loss and subsequent wilting. Irrespective of irradiation, there was an apparent direct correlation between the rate of water loss and the cumulative loss which occurred. (auth)

16115

IONIZING RADIATION AND COAGULATION: EFFECT OF A SINGLE DOSE OF X RADIATION ON THE STERNAL REGION. S. Panichi and I. Bonechi (Univ. of Pisa, Italy). Minerva nucleare 2, 199-202(1958) July-Aug. (In Italian)

The changes induced by a single dose (150 r) of 170 kv x rays on the clotting processes were studied in 30 healthy subjects. A real clotting promoting effect was demonstrated following irradiation. The duration of the blood clotting changes appears to be rather short (about 48 hours) and is attributable partly to purely humoral factors (increased tromboplastin formation) and partly to an increase of the platelet count. (auth)

16116

ACTION OF BETA RADIATION ON THE PROTEUS P18 BACILLUS. P. Mandel, M. Sensenbrenner, and G. Vincendon (Inst. Chim. biol., Inst. Biol. bact., and Faculté de Médecine, Strasbourg). Nature 182, 674-5 (1958) Sept. 6.

Morphological changes are described which were observed in cultures of Proteus following exposure to various dosages of x irradiation. (C.H.)

16117

EFFECTS OF IRRADIATION ON THE BODY. R. H. Mole (MRC Radiobiological Research Unit, Harwell, Eng.). New Scientist 4, 625-7(1958) Aug. 14.

Hazards from industrial applications of radiation are reviewed. (C.H.)

16118

RADIATION AS AN EXPERIMENTAL TOOL IN MAMMALIAN DEVELOPMENTAL NEUROLOGY. Samuel P. Hicks (Harvard Medical School and New England Deaconess Hospital, Boston). Physiol. Revs. 38, 337-56(1958) July.

Embryonal cells were found to vary considerably in radiosensitivity during early development. Cells in certain stages of differentation are so selectively radiosensitive that advantage may be taken of this for experimental purposes in mammalian studies. Direct effects of radiation on the developing nervous system in mammals and the inferences that may be drawn about normal development from a study of malformative processes are reviewed. (C.H.)

16119

OCCURRENCE OF CHROMOSOMAL ABERRATIONS IN PRE-SPERMATOCYTIC CELLS OF IRRADIATED MALE MICE. A. B. Griffen (Roscoe B. Jackson Memorial Lab., Bar Harbor, Maine). Proc. Natl. Acad. Sci. U. S. 44, 691-4(1958) July.

Results are reported from a preliminary study of the effects of irradiation of male mice during the spermatogonial and pre-spermatogonial stage. Results indicate that there is no period of safety after irradiation since translocations and other aberrations may be transmitted for a long period after the irradiation. (C.H.)

16120

ACTION OF RADIATION ON MAMMALIAN CELLS III. RELATIONSHIP BETWEEN REPRODUCTIVE DEATH AND INDUCTION OF CHROMOSOME ANOMALIES BY X-IRRADIATION OF EUPLOID HUMAN CELLS IN VITRO. Theodore T. Puck (Univ. of Colorado Medical Center, Denver). Proc. Natl. Acad. Sci. U. S. 44, 772-80(1958) Aug.

X irradiation of euploid human cells under conditions of stable growth in tissue culture produces chromosomal anomalies whose nature and frequency depend on the dose. Below 50 r the approximate mean lethal dose for cell reproduction in the strains employed practically the only anomalies obtained are those characteristic of single hits. Above this dose range, the incidence of simple breaks is increased, and complex breaks indicative of interaction between two or more hit chromosomes appear and increase with dose. These data support the previously advanced interpretation that the primary process leading to destruction of the reproductive ability of cultured single mammalian cells by x irradiation is a damage to the chromosomes, and they place an upper limit of 40 to 60 r on the value of the dose needed to produce an average of one chromosome abnormality in an euploid, fibroblast-like human cell under these conditions. Pictures of various radiation-produced chromosome breaks, translocations, dicentrics, and ring chromosomes in reproducing, euploid human cells are presented. (auth)

16121

RADIOBIOLOGICAL AND GENETIC STUDIES ON A POLYPLOID SERIES (HAPLOID TO HEXAPLOID) OF SACCHAROMYCES CEREVISIAE. Robert K. Mortimer (Univ. of California, Berkeley). Radiation Research 9, 312-26(1958) Sept.

A related series of Saccharomyces cerevisiae varying in ploidy from haploid to hexaploid was developed by a series of controlled matings. Measurements of linear dimensions of the various cultures indicated a linear increase of cellular volume with ploidy. Genetic analysis of the hybrid cultures revealed normal segregations for the diploid, and segregations for the tetraploid that were consistent with previous findings and with theoretical predictions based on the assumption of random bivalent pairing. Low viability of the triploid meiotic products precluded adequate genetic analyses of these cultures. The hexaploid was found to yield an expected low frequency of phenotypically recessive spores, and the distributions of segregation ratios in different asci agreed quite well with theoretical predictions for three of the four loci studied. It was necessary to assume the fourth locus to be in duplex constitution in order to account for the results obtained for it. The radiation studies on the different cultures showed an increase in resistance to x ray inactivation from haploid to diploid followed by a progressive decrease in radioresistance with further increases in ploidy from diploid through hexaploid. Considerable variability of radiation resistance of diploid cultures was encountered, and the results suggested that this may be at least in part due to variations in degree of genetic homozygosity. The results of the radiation studies are consistent with the assumption that the majority of inactivation of haploid cultures is brought about by recessive lethals, whereas higher-ploidy cultures are inactivated mostly by dominant lethals. (auth)

16122

THE EFFECT OF X-IRRADIATION ON PLASMA LIPROPROTEIN PATTERNS IN THE EMBRYO. Ole A. Schjeide, Nancy Ragan, and Sue Simons (Univ. of California, Los Angeles). Radiation Research 9, 327-40 (1958) Sept.

When 500 r of whole-body x irradiation was administered to chicken embroys on the seventh day of incubation, the concentrations of total lipids and liproproteins of the plasma were reduced with the exception of the S_f 10–30 liproproteins. Irradiation at 10 days, however, resulted in large increases of chylomicrons and smaller increases of S_f 10–30 liproproteins. Such increases in S_f 10–30 lipoproteins were always correlated with decreases in normal levels of S_f 0–10 lipoproteins. Irradiation given at 13 days of incubation sometimes resulted in an increase in chylomicrons by the third day postirradiation and always in relatively heightened concentrations of S_f 10–30 liproproteins. The same dose administered on the eighteenth day of incubation invariably resulted in increased concentrations of S_f 10–30 liproproteins, but the usual increase in denser (–S 0–10) lipoproteins, which occurs at hatching, was reduced by approximately 30 to 40%. When 600 r of x irradiation was given on the day of hatching, elevations in total plasma lipid concentrations were observed due to increases of phospholipid with a concomitant increase of –S 0–10 lipoproteins. (auth)

16123

AN INCREASE IN TOLERANCE IN MICE BY FIELD-FRACTIONATED (SIEVE) X-IRRADIATION. Masatoshi Sakka and Rikisaburo Kamata (Tokyo Medical and Dental Univ.). Radiation Research 9, 341-5(1958) Sept.

Mice irradiated with 50% sieve under our experimental conditions can tolerate three times as much air dose as conventionally treated animals. Results of two fractionated irradiations suggest that the increase in tolerance is not due to the difference in recovery rate. Distribution of deaths produced by equivalent dose of two irradiations suggests a possible difference in mode of death in these irradiations. (auth)

16124

EFFECTS OF A SINGLE LETHAL DOSE OF TOTAL-BODY CO^{60} GAMMA IRRADIATION ON CALVES. George Rosenfeld (National Naval Medical Center, Bethesda, Md.). Radiation Research 9, 346-57(1958) Sept.

The investigation contains clinical, body-weight, temperature, mortality, hematology, and pathology data on the response of the calf (Bos taurus) to a single lethal dose of 600 r of total-body γ-irradiation from Co^{60} in a 4π exposure field. The dose measured in air at the point subsequently occupied by the midline of the animal's body mass, represents the $LD_{40(8)}$ or the $LD_{100(14)}$ for male calves from 3 to 5 months old. The mean survival time for 23 animals maintained until spontaneous death was 9.9 days. The clinical syndrome is described in detail. (C.H.)

16125

EFFECT OF FRACTIONATION OF BETA IRRADIATION ON RAT SKIN. Elly M. Jacobsen, A. K. Davis, and Edward L. Alpen (U. S. Naval Radiological Defense Lab., San Francisco). Radiation Research 9, 358-68(1958) Sept.

Female rats were exposed to a β-ray Sr^{90}-Y^{90} source at a skin dose rate of 14.6 rads/sec. Total doses of 6000 or 12,000 rads were given in fractions of 200 to 1000 rads at 24- or 48-hour intervals. Daily observation was made during the development of the lesion and subsequently on working days until healing was complete. At 200 rads every 48 hours epilation was the only observable response, even at a total dose of 12,000 rads. This total dose fractionated at 400 rads per 48 hours still failed to cause wet desquamation. Daily exposures of 400 rads to a 6000-rad total produced only dry desquamation. The threshold for wet desquamation lies below 600 rads daily to a 6000-rad total, a dose which produces 50% wet lesions. If the total dose was increased to 12,000 rads at 600 rads/day, all the rats had wet lesions. A dose rate of 1000 rads/day shortened the mean time before appearance of wet lesions at a 6000-rad total dose by 2 days, but 1000 rads per 48 hours reduced to 50% the number of rats having wet lesions. When the total dose at 1000-rad per fraction is increased to 12,000 rads, however, spacing no longer has an appreciable effect. Moreover, the injury induced appears to have reached a maximum, and the injury sustained is similar to that observed in the group receiving a total dose of 12,000 rads, 600 rads daily. (auth)

16126

THE RELATIVE EFFECTIVENESS OF NEUTRONS OF 1.4-Mev AND 14-Mev ENERGIES AND GAMMA RAYS IN THE REDUCTION OF FERTILITY IN THE MALE MOUSE. J. F. Spalding, S. B. Hawkins, and V. G. Strang (Los Alamos Scientific Lab., N. Mex.). Radiation Research 9, 369-77(1958) Sept.

Male CF-1 mice were exposed to low weekly doses of Co^{60} γ-rays, 14-Mev neutrons, and fission neutrons over a 10-week period. A complete record of the data from litters was maintained daily for 30 weeks to determine the efficiency of the two neutron energies relative to γ-rays in reducing fertility in the male mouse. The sex ratio of mice born to animals in this study was 0.9 to 1.1 (males/females) and did not differ from that of the controls, regardless of the type or dose of radiation received. Fission neutrons were found to be about 6.5 times as effective in reducing fertility in the male mouse as γ-rays, and 14-Mev neutrons were approximately equal to γ-rays in their effect. Complete sterility was observed in the high-dose fission neutron group, but with the exception of one animal complete recovery was observed when the experiment was terminated. (auth)

16127

THE INDUCTION OF TUMORS IN THE RAT BY ASTATINE-211. Patricia W. Durbin, C. Willet Asling, et al (Univ. of California, Berkeley). Radiation Research 9, 378-97(1958) Sept.

Exposure of rats to sublethal amounts of At^{211} results in the early appearance of large numbers of mammary tumors, many of them malignant, and in the production of an altered functional state simulating menopause. It is evident that the tumor induction is not yet tested for its association with radiation exposure separately from the endocrine disturbance. (auth)

16128

RADIATION PRESERVATION OF FOODS. R. S. Hannan. Roy. Soc. Health 77, 457-65(1957) Aug.

Present trends in Great Britain in the radiation preservation of foods are reviewed. (C.H.)

16129

EXTENDING THE RANGE OF DOSE-EFFECT CURVES FOR IRRADIATED MICE. Willie W. Smith and Jerome Cornfield (National Cancer Inst. and National Institutes of Health, Bethesda, Md.). Science 128, 473-4(1958) Aug. 29.

A simple method is presented for combining information on radiation dose-effect responses measured in different units at different parts of the dosage scale. Application of the method is reported in a study on the effect of colchicine and its derivatives in irradiated mice. (C.H.)

16130

CRITIQUE OF THE LINEAR THEORY OF CARCINOGENESIS. Austin M. Brues (Argonne National Lab., Lemont, Ill.). Science 128, 693-9(1958) Sept. 26.

Present data on human leukemogenesis by radiation fail to indicate a linear relation between dose and effect. Because data are scanty, such a hypothesis cannot be ruled out statistically, but it is less probable than a nonlinear or threshold relation. Other instances in which carcinogenic agents have been examined from the standpoint of dose and dose-rate relations show many clear instances where the relation is nonlinear and none in which linearity is unquestionably demonstrated. Theoretical consideration of the probability that a single critical molecular event, such as a mutation, will give rise to cancer indicate that a malignant change must be an extraordinarily improbable result of such a perturbation. It is also very difficult to reconcile this mechanism with the rather comparable spontaneous and induced-cancer incidences in species with greatly different numbers of cells. Any scheme in which multiple events caused by the carcinogen are required to produce a tumor is incompatible with a linear relation, while, if a disordered state of tissue is an important factor, a true threshold may even occur. There is much evidence, from cancer research of all sorts, indicating that one or both of these conditions is involved in the carcinogenic process. (auth)

16131

TOLERANCE IN THE RADIATION-CHIMAERA. D. W. H. Barnes, C. E. Ford, P. L. T. Ilbery, and J. F. Loutit (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Transplantation Bull. 5, 101-6 (1958) July.

An investigation was made of factors affecting the success of rat or mouse skin grafts in irradiated mice treated with homologous and heterologous bone marrow. It was concluded that in the longer lived radiation chimaera the host has an actively acquired tolerance to the graft and the graft is immunologically paralyzed as regards the host. (C.H.)

16132
A MEGACURIE COBALT-60 FOOD IRRADIATOR. Bernard Manowitz, Otto A. Kuhl, and Leonard Galanter (Brookhaven National Lab., Upton, N. Y.). Paper No. 57-NESC-86 of 2nd Nuclear Engineering and Science Conference, March 11-14, 1957, Philadelphia, Penna. New York, The American Society of Mechanical Engineers, 1957. 6p.

A cobalt-60 food irradiator is described in which flat strips of cobalt sealed in stainless steel are arranged in the form of two parallel slabs. The irradiator meets Quartermaster Corps specifications as to production capacity, minimum dose rate, dose uniformity, and the absence of induced radioactivity. In addition, the irradiator is capable of treating a large variety of package sizes. Calculations are presented which indicate that about two megacuries at a specific activity of 50 to 40 c/gm will be required. A conceptual design of the facility is presented which includes procedures for installation, servicing, and operation. (auth)

Radiation Hazards and Protection

16133 CRC-791
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont. and Canada. Dept. of National Health and Welfare, Ottawa.
LEVELS OF STRONTIUM 90 IN CANADA UP TO MAY 1956. W. E. Grummitt and E. W. Carruthers. Aug. 1956. Revised July 1958. 8p. (AECL-678). $0.20 (AECL).

Results up to May 1956 of a survey to establish Sr^{90} levels in Canada are given. The results are reported as the Sr to Ca ratio in the diet using milk as a representative calcium contributor. (T.R.H.)

16134 UCRL-8276
California. Univ., Berkeley. Radiation Lab.
RADIATION EXPOSURES OF PERSONNEL AT THE 60-INCH CYCLOTRON. Peter F. McWalters, W. Barclay Jones, Margaret A. Kerr, and Roy F. Burton. May 1958. 14p. Contract W-7405-eng-48. $0.50(OTS).

A study has been made of the radiation received by staff members of the 60-inch cyclotron for the period from 1953 to 1957 and of the radiation environment in the target area. The nature of the operations has caused workers to receive an average amount of radiation that was within the formerly accepted limits and in addition is less than the present maximum recommended by the AEC. Namely, the Maximum Permissible Dose (MPD) to the most critical organs, accumulated at any age, shall not exceed 5 rems multiplied by the number of years beyond age eighteen and the dose in any thirteen consecutive weeks shall not exceed 3 rems. There has been a yearly decrease in average exposure however, and constant improvement of techniques lessens the amount of radiation received. (auth)

16135 WASH-1008
Division of Biology and Medicine, AEC.
THE BIOLOGICAL HAZARD TO MAN OF CARBON-14 FROM NUCLEAR WEAPONS. John R. Totter, M. R. Zelle, and H. Hollister. Sept. 1958. 20p. $0.50(OTS).

Some of the problems in quantitative estimation of the hazards of C^{14} to man are considered. The genetic effect is believed to be due to beta decay of C^{14} to N^{14} in the vicinity of genic desoxyribonucleic acid (DNA) causing damage to the DNA molecule. The ratio of mutations caused per transmutation is discussed with respect to the amount of C^{14} in nature, size of genes, and other factors. The uncertainties in calculating or estimating radiation hazards to populations are pointed out, and the C^{14} introduced to the atmosphere by atomic explosions is estimated. (T.R.H.)

16136
SOURCES OF IONIZING RADIATION HAZARDS IN NAVAL MILITARY MEDICINE. James A. Brimson. Arch. Ind. Health 18, 186-9(1958) Sept.

Potential hazards of ionizing radiation which may be encountered by the U. S. Navy are reviewed. The function of the Navy Medical Department in meeting these hazards is discussed. (C.H.)

16137
SUBMARINE MEDICINE ON NAUTILUS AND SEAWOLF. J. H. Ebersole. Arch. Ind. Health 18, 200-7(1958) Sept.

Various aspects of radiation control aboard submarines are discussed, emphasizing important environmental factors. Personnel exposure data from Nautilus and Seawolf are presented. A brief discussion of the significance of nuclear developments to the medical profession is given. (auth)

16138
TISSUE DOSES FROM FAST AND SUPERFAST NEUTRONS. M. I. Shal'nov. Atomnaya Energ. 4, 557-70(1958) June. (In Russian)

Tissue-like phantoms (water, paraffins, etc.) were irradiated by beams of fast and superfast neutrons. Experimental and theoretical curves were plotted for the maximum tissue doses for wide and narrow beams at 1 to 500 Mev. Tentative magnitudes of permissible doses for humans are suggested. (tr-auth)

16139
RADIATION PROTECTION. R. Jaeger. Atomwirtschaft 3, 314-16(1958) Aug.-Sept. (In German)

In the German Federal Republic there is still no federal statute controlling radiation protection, although the government has drafted instructions and guidance manuals. (J.S.R.)

16140
SEARCH FOR FALLOUT IN AUSTRALIA FROM THE CHRISTMAS ISLAND TESTS. L. J. Dwyer, D. W. Keam, D. J. Stevens, and E. W. Titterton. Australian J. Sci. 20, No. 2, 39-41(1957) Aug.-Sept.

A summary is presented of data collected at 17 stations throughout Australia during the period of May 15 to July 22, 1957, which covers the trial and immediate post-trial period of the British hydrogen bomb tests at Christmas Island. Fall-out in Australia from these test explosions was negligible. (C.H.)

16141
RADIOACTIVE FALLOUT IN AUSTRALIA FROM OPERATION 'MOSAIC'. W. A. S. Butement, L. J. Dwyer, C. E. Eddy, L. H. Martin, and E. W. Titterton. Australian J. Sci. 20, No. 5, 125-35(1957) Dec.

Data are summarized from a survey of fall-out in Australia following two atomic weapons tests at Monte Bello Islands in May and June, 1956. Both weapons were in the kiloton range and were fired from towers. The influence of meteorological conditions on fall-out dispersal is discussed. (C.H.)

16142
INCIDENCE OF LYMPHOID RADIOLEUKOSIS IN THE MOUSE PROTECTED AGAINST THE LETHAL EFFECTS OF X RADIATION BY CHEMICAL SUBSTANCES. J. F. Duplan (Pasteur Inst. of Radium, Paris). Compt. rend. soc. biol. 152, 254-6(1958) Sept. 5. (In French)

Experiments were conducted to determine if previous research on the frequency of lymphoid leucoses in several groups of mice with various chemical protectors

could be extended to a strain of mice with different chemical protectors. Polyphenol derivatives were administered to strain XVII mice 60 to 80 days old. They were irradiated at 400 to 750 r. The experiments confirmed that chemical radioprotection does not inhibit radiogenesis of leukemia. (T.R.H.)

16143

HEALTH AND SAFETY IN THE DEVELOPMENT OF NUCLEAR ENERGY. John D. Abbatt. G. E. C. Atomic Energy Review 1, 195-8(1958) Sept.

A description is given of the organization work of the Medical Radiobiology Department of the G.E.C. Atomic Energy Division. This department is responsible for the health and safety of all personnel engaged in any nuclear project undertaken by the Division, and its work ranges from active participation at the design stage through safety control of all aspects of construction to routine surveys of radioactivity around completed reactors. (auth)

16144

LONG-RANGE TRAVEL OF THE RADIOACTIVE CLOUD FROM THE ACCIDENT AT WINDSCALE. N. G. Stewart and R. N. Crooks (Atomic Energy Research Establishment, Harwell, Berks., Eng.). Nature 182, 627-8(1958) Sept. 6.

The path was determined for the radioactive cloud from the accident on October 10, 1957, at Windscale No. 1 Atomic Pile. The influence of meteorological conditions is discussed. The concentration of iodine-131 in the air was measured at a number of sampling points. Data are tabulated on iodine-131 dosage levels at various locations in Great Britain and throughout Europe. (C.H.)

16145

DEPOSITION OF RADIOACTIVITY IN NORTH-WEST ENGLAND FROM THE ACCIDENT AT WINDSCALE. A. C. Chamberlain (Atomic Energy Research Establishment, Harwell, Berks., Eng.) and H. J. Dunster (U. K. Atomic Energy Authority, Risley, Eng.). Nature 182, 629-30(1958) Sept. 6.

Measurements were made of the deposition of radioactivity in north-west England following the accident at Windscale No. 1 Atomic Pile on October 10, 1957. The influence of meteorological conditions is discussed. Data are tabulated on the concentration of various nuclides relative to iodine-131 found in filter paper and grass samples. Data on radiation dosage are included. (C.H.)

16146

RADIOACTIVE CARBON IN THE ATMOSPHERE PRODUCED BY ATOMIC EXPLOSIONS. K. O. Münnich and J. C. Vogel (Univ. of Heidelberg, Germany). Naturwissenschaften 45, 327-9(1958). (In German)

The change in the C^{14} content of plants in middle Europe and southern Africa in the last few years was investigated. The C^{14} content of consecutive tree rings was determined in addition to plants and seeds of more recent origin. The results showed that in the last 600 years no noticeable change in the C^{14} content could be detected. In the period from 1930 to 1953 it did fall slightly because of the release of practically C^{14}-free CO_2 into the atmosphere from the burning of coal and oil. In 1954 an almost linear increase of the C^{14} content of plants began in middle Europe. The increase in southern Africa was less. The mixing time, τ, of the atmospheres in the northern and southern hemispheres was calculated as 0.6 $\tau = 1.5^{+0.6}_{-0.4}$ years. Possible mechanisms for the mixing are discussed. (J.S.R.)

16147

HAZARDS OF ATOMIC RADIATION. Peter Alexander. New Scientist 4, 622-4(1958) Aug. 14.

The United Nations scientific committee's report on the effects of atomic radiation is reviewed. It is pointed out that at the present time the medical uses of x rays present the largest source of danger in highly developed countries, while in the East the threat from bomb fallout has relatively greater significance. (C.H.)

16148

RADIOACTIVE FALLOUT. W. F. Libby (U. S. Atomic Energy Commission, Washington). Proc. Natl. Acad. Sci. U. S. 44, 800-20(1958) Aug.

The more recent data, particularly on bomb carbon-14, when taken together with the earlier data on bomb fission products and tritium, give us some confidence in our present understanding of the fallout mechanism. All these observations and considerations afford unprecedented opportunities for the study of meteorology and geophysics, particularly in an international cooperative effort such as the International Geophysical Year. (auth)

16149

CURRENT STRONTIUM-90 LEVEL IN DIET IN UNITED STATES. J. Laurence Kulp and Rieta Slakter (Columbia Univ., New York). Science 128, 85-6(1958) July 11.

Measurements were made of the concentration of strontium-90 found in approximately 100 food samples collected throughout the United States. Samples of important calcium sources such as milk, vegetables, cereals, and tap water were included. From an analysis of the data it is concluded that the strontium-90 content in the diet of an average United States citizen in 1957 was about 6.5 Sunshine Units, corresponding to an equilibrium base level of 1.6 Sunshine Units, since the discrimination factor between diet and base appears to be about 4. If the diet concentration remains constant for a decade, the equilibrium bone level of 1.6 Sunshine Unit would be approached by young children. New-born children would have about half of this value on account of fetal discrimination, and adults would reach only 20 to 30 percent of the equilibrium level, because of the slow rate of exchange of calcium in bone. (C.H.)

16150

MICE, MEN, AND FALLOUT. THE POTENTIAL DANGER OF STRONTIUM-90 IS APPRAISED ON THE BASIS OF DATA FROM ANIMAL EXPERIMENTS. Miriam P. Finkel (Argonne National Lab., Lemont, Ill.). Science 128, 637-41(1958) Sept. 19.

The potential danger for man of strontium-90 from fall-out is appraised on the basis of data from animal experiments. (C.H.)

16151

RADIATION-PROTECTIVE EFFECTS OF YEAST EXTRACT AND YEAST RIBONUCLEIC ACID. Katherine D. Detre and Stuart C. Finch (Yale Univ., New Haven, Conn.). Science 128, 656-7(1958) Sept. 19.

The injection of a crude yeast autolysate was found to exert a moderate amount of protection against radiation injuries in rats and mice. (C.H.)

16152

SAFE DESIGN AND USE OF INDUSTRIAL BETA-RAY SOURCES. National Bureau of Standards Handbook 66. Washington, U. S. Department of Commerce, 1958. 33p. Available from U. S. Government Printing Office, Washington, for $0.20.

Procedures are outlined to serve as a guide for the safe design, manufacture, installation, use, mainte-

nance, and disposal of sealed beta-ray sources for industrial applications. (C.H.)

16153

SAFE HANDLING OF BODIES CONTAINING RADIOACTIVE ISOTOPES. National Bureau of Standards Handbook 65. Washington, U. S. Department of Commerce, 1958. 26p. Available from U. S. Government Printing Office, Washington, for $0.15.

Procedures are outlined as a guide for surgeons, pathologists, and funeral directors handling bodies containing radioactive isotopes. (C.H.)

Radiation Sickness

16154

THE DYNAMICS OF THE CHANGES IN THE ERYTHROCYTES DURING ACUTE RADIATION SICKNESS. RESULTS OF A PHOTOELECTRIC INVESTIGATION OF THE KINETICS OF HAEMOLYSIS. I. A. Terskov and I. I. Gitel'zon (Krasnoiarsk Medical and Agricultural Inst.). Biophysics (USSR) (English Translation) 4, 511-25(1958).

Results are reported from a photoelectric investigation of the kinetics of hemolysis and the relationship of hemolysis to the radiation syndrome. Photoelectric measurements were made of the breakdown of erythrocytes under the influence of a known hemolytic agent and the distribution of resistance among the erythrocytes, or erythrogram, was established. Data on the erythrocyte stability of irradiated rabbits show that changes in the physicochemical properties of erythrocytes begin at the moment of irradiation and develop progressively to death. No latent period in the reaction was seen. The regular changes during the development of the radiation syndrome are divided into four phases on the basis of corresponding periods of the clinical disease. Each is discussed. The regularity of the changes in the erythrogram is suggested as a means for the detection and definition of the course of acute radiation damage. (C.H.)

16155

A POSSIBLE RELATIONSHIP, DIRECT OR INDIRECT, BETWEEN THE NUMBER OF CASES OF LEUKEMIA AND THE RADIOACTIVITY OF THE SOIL. Marcel Roubault, Jean Pascal, and René Coppens. Compt. rend. 247, 369-72(1958) July 21. (In French)

In an area of approximately 3000 km^2, of which 1200 km^2 is granite terrain, cases of leukemia in adults are six times more numerous than on other terrain. The granite was found to be very uraniferous. The cases are found along the border of the massif where the radioactivity is generally more elevated. After the editing of this article, an added note reported 12 new cases in this region, 7 on the granite terrain, 3 on the other terrain, and 2 infants. The terrain does not seem to be a factor in leukemia in infants. (J.S.R.)

16156

INHIBITION OF POSTIRRADIATION DIURESIS IN RATS BY PITRESSIN. Clyde M. Williams and George M. Krise (Univ. of Texas and U. S. Air Force, Austin, Texas). Science 128, 475-6(1958) Aug. 29.

Thirst and diuresis was prevented in rats exposed to 1500 r gamma radiation by the injection of 500 milliunits of Pitressin in 0.1 ml of peanut oil. (C.H.)

Radiography

16157 UCRL-8400

California. Univ., Berkeley. Radiation Lab.

A BIBLIOGRAPHY OF BIOLOGICAL APPLICATIONS OF AUTORADIOGRAPHY, 1954 THROUGH 1957. Muriel E. Johnston. July 1958. 43p. Contract W-7405-eng-48. $1.25(OTS).

The bibliography is designed to be added to that compiled by G. A. Boyd in "Autoradiography in Biology and Medicine." It primarily covers the literature of the years 1954 through 1957, but it contains also some entries for 1953 omitted from Boyd's work, and those entries for 1958 encountered in the literature search. No attempt was made to include articles which use autoradiography merely as an adjunct to the technique of paper chromatography. (auth)

16158

PHOTOGAMMAGRAM RECORDING FOR CLINICAL USES. D. Frost (Städt. Rudolf-Virchow-Krankenhaus, Berlin). Atompraxis 4, 254-60(1958). (In German)

A new scanning process was developed for graphic representations of the distribution of radioactive isotopes. It solves the problem of showing a continuous radiation field in a graphically continuous manner. For this purpose the statistically fluctuating impulse frequency is transformed into a direct current with static impulses. This controls a tuning indicator valve, the screen of which is projected into an x-ray film. The superimposition of the "photogammagram" with the x-ray picture allows an exact geometrical correlation of object and picture. The continuous recording of the light traces supplies a resolution accumulation centers with simultaneous indication of the boundaries of the active fields. (auth)

16159

EXPERIMENTAL METHODS FOR QUANTITATIVE AUTORADIOGRAPHY IN MICROBIOLOGY AND CELL RESEARCH. R. Tzschaschel (Institut für Mikrobiologie und Experimentelle Therapie, Jena, Germany). Atompraxis 4, 265-70(1958). (In German)

Surface-prepared covered glasses are especially suitable for the production of autoradiographic microbe preparations on account of the definite improvement they offer in regard to microscopic evaluation. The microorganisms are not spread on the slide as is generally done, but rather are sprayed on the glass with a spraying device and covered with a removable film or liquid emulsion. The pouring of the emulsion is made much easier by the use of a special pouring device. For standardizing the emulsion, activity determinations must be carried out on cell collectives with the usual counter methods, which can be made sufficiently accurate by using an improved pipette technique. The microscopic evaluation of the autoradiographs is carried out by means of silver-grain determination based on a cross-counting procedure, the accuracy of which is discussed. An example of standardization, i.e. the determination of the relationship between the marking of the individual cell and the autoradiographic effect, shows the usefulness of this method for quantitative purposes. (auth)

Radiotherapy

16160

THE COMBINED EFFECT OF RADIOGOLD AND NITROGEN MUSTARD AND RADIOGOLD AND CERTAIN OTHER COMPOUNDS ON THE EHRLICH ASCITES CARCINOMA. Richard W. Whitehead, Raymond R. Lanier, and Jerry B. Thompson (Univ. of Colorado Medical Center, Denver). Cancer 11, 929-32 (1958) Sept.-Oct.

Nitrogen mustard and radiogold in combination markedly inhibit growth of the intraperitoneal ascitic

form of the Ehrlich ascites carcinoma in mice. The best inhibiting dose of radiogold, 15 mc/kg, was the most toxic one; 7.5 mc/kg was found to be the most effective dose with the least toxicity. The results of similar experiments using several other drugs, without significant success, are briefly presented. Advantages in the use of an ascitic tumor in research of this nature are discussed. (auth)

16161

CONSIDERATIONS ON THE THERAPEUTIC USE OF HIGH ENERGY ELECTRON BEAMS. G. Lovera (Univ. of Turin). Minerva nucleare 2, 204-11(1958) July-Aug. (In Italian)

The theoretical grounds of the therapeutic use of electron beams and the most important contributions on this subject are considered. Particular attention is given to the description of the physical characteristics of the beam of electrons in relation to the absorption of the beta radiations by the tissues. With beams of accelerated electrons between 1 and 15 Mev an almost constant absorption by the surface occurs at a depth which varies according to the generating voltage, with a rapid drop of the dose immediately under this level. These two features, rapid drop of the dose under a certain level and possibility of varying the depth of absorption of the beam, make this type of radiation particularly valuable in the treatment of superficial or relatively superficial tumoral lesions. As the acceleration tensions increase the beam of electrons tends to lose these characteristics and to assume those of radiations formed by particles with a greater mass, i.e. maximum ionization localized near the end of the pathway of the beam; these characteristics make this type of radiation particularly suitable for the treatment of deep foci. The apparatus for the production, extraction, definition, and localization of the beams of electrons is also discussed, both as regards linear and circular accelerators, together with the problems concerning the clinical use, the biological efficacy, and the therapeutical results of this type of radiation. (auth)

16162

THE MAIN PROBLEMS OF RADIOTHERAPY IN LUNG CANCER PATIENTS. L. M. Gol'dshtein (Inst. of Oncology of the Academy of Medical Sciences of the USSR). Problems Oncol. (USSR) (English Translation) 3, 474-82(1957).

Indications and contraindications for radical and palliative radiotherapy in lung cancer are discussed. Modern methods of radiotherapy combined with surgery and chemotherapy are reviewed. Data are tabulated on the survival time of 58 patients with inoperable forms of lung cancer treated with x-ray therapy. Two patients were alive after four years. The influence of age on prognosis is discussed. (C.H.)

16163

RADIATION DOSE TO THE LENS IN TREATMENT OF TUMORS OF THE EYE AND ADJACENT STRUCTURES. POSSIBILITIES OF CATARACT FORMATION. George R. Merriam, Jr. and Elizabeth F. Focht (Memorial Center and Columbia-Presbyterian Medical Center, New York). Radiology 71, 357-69(1958) Sept.

The amounts of radiations reaching the lens from the treatment of tumors of the eye, orbit, and adjacent structures with some of the usual techniques have been measured. The lens doses have been related to the probability of radiation cataracts. The sites of the lesions for which measurements were taken include the antrum, nasopharynx, ethmoids, cerebrum, pituitary gland, lacrimal gland, orbit, hard palate, nose, lids, and the eye itself (retinoblastoma). The problem of shielding has been discussed. Cataracts were found to be most likely with the techniques used in the treatment of carcinoma of the antrum with invasion of the floor of the orbit, carcinoma of the nasopharynx with involvement of the ethmoids, and carcinoma of the hard palate only if the cone had to be so angled that the eyes were in the direct beam. In view of the severity of these lesions, however, a cataract is a minor complication. In radiotherapy for carcinoma of the eyelids, a cataract would be likely only if radon seeds or radium plaques were used. In general, the probability of a cataract is high whenever moulages or implants of gamma-emitting radioactive substances are used in the neighborhood of the eye, since it is difficult to shield the lens from such sources. In the x-ray treatment of retinoblastoma, the complication of radiation cataract can usually be avoided by the use of conservative tumor doses and accurate beam direction. (auth)

Toxicology Studies

16164

AN ANIMAL INHALATION EXPOSURE UNIT FOR TOXICITY SCREENING. Leonard J. Leach and Charles J. Spiegl (Univ. of Rochester, N. Y.). Am. Ind. Hyg. Assoc. J. 19, 66-8(1958) Feb.

Details are given for the construction of an inhalation exposure unit designed for pilot scale screening studies of chemical materials on laboratory animals. The primary features of the new unit are versatility and ease of operation and maintenance. (C.H.)

16165

HEALTH HAZARDS AND CONTROL OF AN EPOXY RESIN OPERATION. W. H. Kingsley (Sandia Corp., Albuquerque, N. Mex.). Am. Ind. Hyg. Assoc. J. 19, 258-60(1958) June.

Epoxy resins were found to be toxic due to the release of tertiary and tetra-amines in the wet state before hardening. Experience at Sandia Corporation with the use of these resins is presented, and procedures are described for personnel protection. The recommendations include high standards of personal and work-area cleanliness, personel awareness of the toxicity of materials associated with epoxy resins, and supervisory recognition of early symptoms of sensitization. (J.R.D.)

16166

SELECTIVE TOXICITY OF RADIOACTIVE SULFATE FOR MOUSE CARTILAGE AND BONE MARROW. Raymond G. Gottschalk and Howard N. Beers (Veterans Administration Center, Martinsburg, W. Va. and George Washington Univ. School of Medicine, Washington). Arch. Pathol. 65, 298-311(1958) Mar.

Doses of 0.001 to 5 mc per gram S^{35} sulfate were injected into young adult mice. The effects on body weight, food and water intake, blood cells, and varied tissues were studied. The highest doses produce death from destruction of the hematopoietic tissues. After 0.5 and 1 mc. per gram the epiphysial cartilage plates are selectively and irreversibly destroyed and only temporary leukopenia occurs. These toxic effects are related to the metabolic affinities of S^{35} sulfate. They might warrant attempts at therapy with S^{35} sulfate in cases of terminal widespread chondrosarcomas. (auth)

16167

HEMATOLOGIC EFFECTS OF LARGE AMOUNTS OF RADIOACTIVE SULFATE. Raymond G. Gottschalk,

Howard N. Beers, and Phyllis O. Miller (George Washington Univ. School of Medicine, Washington and Veterans Administration Center, Martinsburg, W. Va.). Proc. Intern. Soc. Hematol. 302-12(1958).

Tracer amounts of radioactive sulfate selectively localize in tissues rich in mucopolysaccharides, namely cartilage, newly formed connective tissue, mucin secreting epithelia, and also human chondrosarcomas and carcinomas of the colon and breast. These affinities suggest possible therapeutic applications of large doses of S^{35}-sulfate. In mice massive doses destroy the red bone marrow, whereas smaller doses produce necrosis of growing cartilage. Suckling rats injected with about 0.1 mc/gm develop severe shortening of the limbs. In any therapeutic attempt with S^{35}-sulfate, the toxicity to the marrow would be the limiting factor. Changes in the blood picture should be used as a warning sign of toxicity. Transitory leukopenia develops in mice soon after injection of 0.5 to 2 mc/gm and disappears in 3 to 7 weeks. Massive fatal leukopenia occurs after 2 or 5 mc/gm. Both lymphocytes and granulocytes are reduced. The maximum decrease of the red blood cell counts is to about 70% of the original level. These changes are illustrated and discussed. (auth)

Tracer Applications

16168

IN VITRO ABSORPTION OF RADIOIRON BY EVERTED POUCHES OF RAT INTESTINE. Elmer B. Brown, Jr. and Bertram W. Justus (Washington University School of Medicine, St. Louis). Am. J. Physiol. 194, 319-26 (1958) Aug.

Everted pouches of rat intestine prepared by the technique of Wilson and associates were used to measure absorption of radioiron. Iron was taken up equally well in vitro by all segments of the rat's small intestine; but when the iron was given orally in vivo, a distinct gradient, highest in duodenum and progressively smaller in the distal segments was demonstrated. There was little transfer into the inner serosal pouch. Transfer of iron in this preparation was by a process of passive transport. It was not appreciably affected by changes in pH, various metabolic inhibitors, buffer systems, or added substrates. Ferrous iron was significantly better taken up by the intestinal tissue, but transfer into the inner pouch fluid was greater with ferric iron. (auth)

16169

TRITIUM IN BIOLOGICAL STUDIES. W. E. Kisieleski and F. Smetana (Argonne National Lab., Lemont, Ill.). Atompraxis 4, 261-5(1958).

Tritium as a tool for studying intermediary metabolism and as a clinical tool for diagnosis and radiotherapy is discussed in the light of recent developments in the labeling of organic compounds with tritium by the self-irradiation method. The assay of tritium by liquid scintillation counting is discussed, and the design of an automatic windowless scanner for tritiated chromatograms is described. (auth)

16170

FACTORS MODIFYING RADIOSTRONTIUM EXCRETION IN MAN. Herta Spencer, Joseph Samachson, Bernard Kabakow, and Daniel Laszlo (Montefiore Hospital, New York). Clin. Sci. 17, 291-301(1958) May.

A metabolic study was conducted to compare the effects of calcium, of ammonium chloride, and of the combination of the two agents upon the excretion of radiostrontium in man. Urinary calcium and radiostrontium excretion increased markedly when calcium gluconate was administered intravenously or NH_4Cl was given orally. The effects of the two agents administered simultaneously were additive. This additive effect is apparently due to increased concentration of calcium ions in the extracellular fluid leading to increased excretion of calcium and radiostrontium, decreased deposition of the two elements in bone, and increased removal of deposited calcium and radiostrontium from bone during NH_4Cl-acidosis. NH_4Cl administered 15 days after exposure was as effective in enhancing radiostrontium excretion as in the early phase. The effectiveness of high calcium diet in promoting urinary radiostrontium excretion seems to depend on its effectiveness in raising the urinary calcium excretion. Regardless of this effect, NH_4Cl is still capable of enhancing radiostrontium excretion significantly due to interference with the metabolism of the absorbed dietary calcium as described above. (auth)

16171

COMPARATIVE METABOLISM OF CALCIUM AND STRONTIUM IN LACTATION. R. H. Wasserman, F. W. Lengemann, and C. L. Comar (Oak Ridge Inst. of Nuclear Studies, Tenn.). J. Dairy Sci. 41, 812-21(1958) June.

The comparative metabolism of calcium and strontium in the lactating and nonlactating goat was studied, using double tracer methods. At steady state, calcium was preferentially secreted into milk by a factor of about 11 over strontium in its passage from diet to milk. With corollary data from nonlactating animals, it was found that the largest amount of discrimination took place in the gastrointestinal absorption of these alkaline earths, calcium being absorbed from three to four times that of strontium. The over-all discrimination of 0.09 between milk and diet resulted primarily from the following discrimination factors: absorption, 0.24; urinary excretion, 0.60; transfer from plasma to milk, 0.61. Under steady state conditions, the relative Sr*/Ca* ratios were diet = 1, plasma = 0.23, skeleton = 0.23, milk = 0.09, and urine = 4.0. These values indicate that there is no differential movement of calcium and strontium between blood and bone, and that strontium is preferentially excreted in the urinary process. (auth)

16172

FATE OF P^{32}-LABELED BAYER $^{21}/_{199}$ IN THE WHITE RAT. D. A. Lindquist, E. C. Burns, C. P. Pant, and P. A. Dahm (Iowa State Coll., Ames). J. Econ. Entomol. 51, No. 2, 204-6(1958) Apr.

Data are presented on the tissue distribution of phosphorus-32 labeled 0-(3-chloro-4-methylumbelliferone) 0,0-diethyl phosphorothioate in rats. (C.H.)

16173

MODES OF ENTRY OF STRONTIUM INTO PLANT ROOTS. Juan de Dios Lopez Gonzalez and Hans Jenny (Universidad de Granada and Junta de Energia Nuclear, Spain and Univ. of California, Berkeley). Science 128, 90-1(1958) July 11.

Data are summarized from a series of experiments on the modes of entry of strontium into plant roots. Strontium-85 was used as a tracer. (C.H.)

16174

RETENTION OF RADIOACTIVE BONE-SEEKERS. William P. Norris, Sylvanus A. Tyler, and Austin M. Brues (Argonne National Lab., Lemont, Ill.). Science 128, 456-62(1958) Aug. 29.

The power function has been found to provide a satisfactory empirical description of the retention of several

radioactive isotopes which are preferentially deposited in skeletal tissue. The extent to which it may apply to bone-seeking elements in general is not yet known. The ease of mathematical manipulation of the power retention function allows the derivation of several relationships which can be used to determine permissible daily intake or integrated radiation dosage, or to evaluate important factors relating to individuals who have already accumulated skeletal deposits. The power function indicates clearly that, in its area of application, the concept of biological half-times is completely fallacious and may result in gross errors both actually and conceptually. The method offers opportunities for more accurate and realistic approaches to the problems of poisoning by radioelements as well as in calculations of allowable daily intake levels and body concentrations of radioactive bone-seekers. It indicates that major differences in integrated radiation dosage may obtain, depending upon the conditions of exposure, and points out that permissible body burdens should be assessed in view of the manner in which the body burden is obtained. 34 references. (auth)

16175

IODINE-131 FALLOUT IN BOVINE FETUS. L. van Middlesworth (Univ. of Tennessee, Memphis). Science 128, 597-8(1958) Sept. 12.

Determinations were made on the I^{131} content of the thyroid gland removed from pregnant cows and on laryngothyroid areas from their fetuses. Findings are correlated to fall-out activity during the period. Data on iodine-131 content are compared with data on 400 thyroids from cattle from the same area. Eighty-five percent of the 7- to 9-month fetuses had greater iodine-131 concentration in their thyroids than did their dams. Only 68 percent of the 6- to 7-month fetuses had more iodine-131 in their thyroids than did their dams. Implications of the findings are discussed. (C.H.)

CHEMISTRY

16176 AECU-3825

Stanford Research Inst., Menlo Park, Calif.

REACTIONS OF TITANIUM WITH WATER AND AQUEOUS SOLUTIONS. Final Report [for] March 15, 1957 to June 15, 1958. Fred E. Littman and Frank M. Church. June 15, 1958. 42p. SRI Project No. SD-2116. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract No. 1088.

The work described delineates the engineering conditions under which it is safe to use titanium as a material of construction in the presence of oxygen. These conditions apply not only to the atomic energy industry but to chemical processing as well. The results indicate that there may be several separate conditions which must be met before a self-sustaining reaction can occur. Obviously, a favorable heat balance must exist—that is, the rate of heat produced by the reaction must exceed the rate of heat dissipation by radiation, conduction, and convection. For the reaction to remain self-sustaining, another condition has to be met: an unprotected surface must be continuously exposed. It is postulated that this happens when the surface temperature reaches the melting point of the metal, the metal oxide, or a eutectic between the two and also when the metal and its oxide are mutually soluble. These conditions probably restrict the occurrence of autoignition of massive shapes of metals to a relatively small number of metals. Although zirconium appears to burn with more intense heat than titanium, it is much more resistant to spontaneous ignition. This may be due to its higher heat conductivity (0.04 vs. 0.014 $cal/cm^2/cm/°C/sec$) compared with titanium, which would allow it to dissipate the heat of the initial reaction more readily. The exact range of conditions leading to the autoignition of zirconium and possibly other metals will be the subject of another study. (auth)

16177 LAMS-2206

Los Alamos Scientific Lab., N. Mex.

ELECTROPLATING OF TAPERED SILVER DEPOSITS ON STAINLESS STEEL AND INCONEL TUBES FOR A HIGH-CAPACITY MERCURY-COLUMN RHEOSTAT. L. J. Quintana, J. M. Taub, and R. Seegmiller. Jan. 1958. 18p. Contract W-7405-eng-36. $0.75(OTS).

A tailored unit resistance was achieved in the conductor tubes of a high-capacity mercury-column rheostat by electroplating a tapered deposit of silver onto the Inconel and stainless steel conductor tubes. The apparatus and procedure are described. (J.R.D.)

16178 MCW-1417

Mallinckrodt Chemical Works, St. Louis.

AN INVESTIGATION OF THE WATER GAS REACTION AS A MEANS OF UPGRADING AQUEOUS HF. T. A. Baggett, R. Cutler, E. N. Nelson, and J. A. Kennelley. Aug. 15, 1958. 15p. Contract W-14-108-eng-8. $0.75(OTS).

The water gas reaction, $C + H_2O = CO + H_2$, has been investigated as a method of converting 70% HF to anhydrous HF. Marked variations in carbon reactivity were observed. Two types of charcoal yielded a product assaying 99+% HF at 900 and 1000°C with contact times of ten seconds or less; foundry coke, however, required a contact time of 20 seconds at 1000°C to yield an equivalent product. All carbon source materials tested required very extended contact times (60 seconds or more) to produce essentially anhydrous HF at 800°C. The feasibility of this process has been demonstrated in a laboratory-sized apparatus, but associated problems such as heat transfer and materials of construction would make large scale applications of this process unattractive. (auth)

16179 NP-6937

Midwest Research Inst., Kansas City, Mo.

RESEARCH ON HIGH TEMPERATURE METALLO-ORGANIC AND INORGANIC BASE FLUIDS. Quarterly Progress Report No. 1 [for] May 1–July 31, 1958. L. W. Breed. Aug. 14, 1958. 34p. MRI Project No. 2194-C. Contract AF33(616)-5718.

A program has been undertaken to compile, encode, and correlate physical and chemical properties of known inorganic and metallo-organic compounds. The properties of particular interest are melting point, boiling point, thermal stability, and chemical structure. In this report, the sources of data are discussed in detail, and the method selected to cover the chemical literature is described. Also, coding procedures, preparation of IBM punchcards, and sorting techniques are outlined. In the coverage of the literature, about 20,000 data cards have already been prepared, and about one-third of these data has been processed and is ready to be transferred to IBM punchcards. (auth)

16180 ORO-172

Arkansas. Univ., Fayetteville. Coll. of Arts and Sciences.

REPORT ON ARKANSAS 400 KV COCKCROFT-WALTON ACCELERATOR AND NUCLEAR CHEMISTRY RESEARCH. R. W. Fink. Mar. 1, 1958. 52p. Contract AT(40-1)-277. $1.50(OTS).

Extract from Progress Report March 1, 1958.

Description, installation, and operation of the 400-kv positive ion accelerator is presented. A study of deuteron-irradiated silver targets by x-ray diffraction is presented. Preliminary results were obtained in several runs on the activation cross sections of bismuth for 14.8-Mev neutrons. An apparatus was designed and built in an attempt to measure half lives in the 10^{-3} second range. The direct determination of the L/K capture ratio in Fe^{55} decay is discussed. The half life of Tl^{204} is given. (W.L.H.)

16181 TID-2021(Del.)
Technical Information Extension, AEC.
NUCLEAR SCIENCE AND TECHNOLOGY. VOL. 2, NO. 1. Feb. 1956. Decl. with deletions June 10, 1958. 36p. $6.30(ph OTS); $3.00(mf OTS).

Three articles appearing in this issue. Separate abstracts have been prepared for each. (T.R.H.)

16182 TID-2021(Del.)(p.27-44)
Battelle Memorial Inst., Columbus, Ohio.
PILOT-PLANT STUDIES ON SOLVENT-EXTRACTION PURIFICATION OF MANTLE-GRADE THORIUM NITRATE. Dennis D. Foley and Robert B. Filbert, Jr. p.27-44 [of] NUCLEAR SCIENCE AND TECHNOLOGY. VOL. 2, NO. 1 (deleted). Feb. 1956. 18p.

A pilot plant processing 5.6 lb/hr of thorium and consisting of three 10-stage mixer-settler units and suitable tanks and pumps was operated to provide process design data on the purification of thorium nitrate by solvent extraction. The solvent used was a nominal 30 vol. % solution of tributyl phosphate in an aromatic solvent. Based on a 26-hr test period, the over-all thorium recovery was 99.89 per cent. The aqueous product produced was of purity necessary for production of thorium metal for atomic energy purposes. (auth)

16183 TID-2021(Del.)(p.61-9)
Battelle Memorial Inst., Columbus, Ohio.
PREPARATION OF FUEL ELEMENTS BY CATHODIC CODEPOSITION OF URANIUM OXIDE WITH METALS OR OTHER OXIDES. J. McCallum, C. R. Konecny, and C. L. Faust. p.61-9 [of] NUCLEAR SCIENCE AND TECHNOLOGY. VOL. 2, NO. 1 (deleted). Feb. 1956. 9p.

Electrodeposition is suggested as a method for building small fuel elements of intricate shapes with controlled compositions and dimensions. Exploratory work has shown that the art of electroforming might be used to build structures with a high surface to volume ratio that contain dense layers of uranium oxides between electroformed layers of metals. Alternately, a preformed structure of stainless steel or other metal can be given a coating containing uranium and then can be clad with another metal by electrodeposition. Uranium oxide–nickel combinations are described that varied from 27 to 70 wt. % uranium and 3 to 58 wt. % nickel. (auth)

16184 TID-2021(Del.)(p.71-2)
Oak Ridge National Lab., Tenn.
COMMENTS ON REACTOR FUTURES ITEM BY MALLON AND PEARCE. H. F. McDuffie. p.71-2 [of] NUCLEAR SCIENCE AND TECHNOLOGY. VOL. 2, NO. 1 (deleted). Feb. 1956. 2p.

In discussion of a proposed design for a high-flux homogeneous research reactor for large-volume irradiations the uranium peroxide precipitation and radiolytic gas problems are pointed out. (T.R.H.)

16185 TID-2022(Del.)
Technical Information Service Extension, AEC.
NUCLEAR SCIENCE AND TECHNOLOGY. VOL. 2, NO. 2. June 1956. Decl. with deletions June 10, 1958. 62p. $10.80(ph OTS); $3.90(mf OTS).

Four articles are included in this issue. Separate abstracts have been prepared for each paper. (T.R.H.)

16186 TID-2022(Del.)(p.83-96)
Oak Ridge National Lab., Tenn.
THE HRT AND THE "WALK-AWAY" PROBLEM. M. Tobias. p.83-96 [of] NUCLEAR SCIENCE AND TECHNOLOGY. VOL. 2, NO. 2 (deleted). June 1956. 14p.

The "walk-away" phenomenon has been analyzed using linearized stability equations. Calculations were made at 5 and 10 Mw and at several average core temperatures between 240 and 300°C. The effects upon stability of several factors were studied, among which were internal recombination and over-pressure. The calculations for the design conditions of the Homogeneous Reactor Test (HRT) indicate that it will be stable against walk-away. Examination of the results shows the paramount cause of instability to be insufficient overpressure. Also, increasing fuel feed rate, the ratio of mass of solution held in the high-pressure system to that in the low-pressure system, as well as decreased temperature, core concentration, and power, will increase reactor stability against walk-away. The use of copper recombination is seen to be of major importance in suppressing this troublesome phenomenon. Although walk-away may be prevented by the use of automatic controls in the heat-removal system, such as are provided in the design of the HRT, simple and direct remedies exist in the proper choice of inherent reactor variables, such as fuel feed rate. Indeed, any procedure which acts to keep core concentration from rising will help to restrain walk-away. (auth)

16187 TID-2022(Del.)(p.97-110)
Oak Ridge National Lab., Tenn.
FEASIBLE CHEMICAL FORMS FOR A THORIUM BREEDER BLANKET. M. H. Lietzke and R. W. Stoughton. p.97-110 [of] NUCLEAR SCIENCE AND TECHNOLOGY. VOL. 2, NO. 2 (deleted). June 1956. 13p.

(Published in Ind. Eng. Chem. 49, 202-7(1957) Feb. and previously abstracted in Nuclear Science Abstracts Vol. 11, abstract No. 4701.)

16188 TID-2022(Del.)(p.111-21; 125-31)
Oak Ridge National Lab., Tenn.
HIGH-TEMPERATURE CERAMIC POWER REACTORS USING SiC–Si FUEL ELEMENTS. J. R. Johnson, R. L. Hamner, A. J. Taylor, and J. M. Warde. p.111-21; 125-31 [of] NUCLEAR SCIENCE AND TECHNOLOGY. VOL. 2, NO. 2 (deleted). June 1956. 17p.

The physical properties of some ceramic materials with thermal neutron microscopic absorption cross sections less than 0.5 barn are surveyed for use in gas-cooled power reactors. An Si–SiC system was selected for further development. Fabrication, radiation damage, erosion-corrosion, heat flux, and penetrability studies are described. Design features of the gas-cooled ceramic power breeder reactor are described. (T.R.H.)

16189 TID-2022(Del.)(p.202-9)
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
FABRICATION OF EXPERIMENTAL URANIUM–MOLYBDENUM FUEL RODS BY THE DRAWING OF COEXTRUDED ROUND RODS. H. J. Snyder. p.202-9 [of] NUCLEAR SCIENCE AND TECHNOLOGY. VOL. 2, NO. 2 (deleted). June 1956. 8p.

The fabrication of 0.300 in.-diameter fuel-rod stock, having uranium–12 wt. % molybdenum fuel and 0.030-

in.-thick Zircaloy-2 cladding, by the drawing of coextruded round rods is discussed. The data presented indicate that both cold (room temperature) and hot (1900 and 1300°F) drawing can be utilized to produce 0.300-in.-diameter fuel rods from 0.437- to 0.625-in.-diameter extruded rounds. This represents cross-sectional reductions of 53 to 77 per cent, respectively. Experimental material yields range between 82 and 92 per cent, but indications are that increased material yields would result if proper tooling and longer coextruded rounds were employed. Molybdenum disulfide in lacquer is a satisfactory lubricant for cold drawing, and a mixture of 50 wt. % graphite and 50 wt. % table salt suspended in SAE-10 motor oil is a suitable lubricant for hot drawing. Individual drawing reductions of approximately 30 per cent are necessary in order to consistently perform drawing and repeatedly produce a usable configuration between the fuel and the cladding. (auth)

16190 AEC-tr-3301
INVESTIGATION OF THE CONNECTION BETWEEN THE ELECTRO-CONDUCTIVITY AND THE ADSORPTION PROPERTIES OF ZINC OXIDES. I. A. Myasnikov. Translated by Oak Ridge National Lab. Library Staff from Zhur. Fiz. Khim. 31, 1721-31(1957). 19p.

The electric conductivity of thin ZnO films for direct and alternating currents in a vacuum, in an oxygen atmosphere, and under reaction conditions for dehydrogenation and oxidation of isopropyl alcohol was investigated. The regular connection between the adsorption and catalytic properties of the semiconductor catalysts and their electric properties was established. (J.R.D.)

16191 AEC-tr-3345
STUDY OF DIFFUSION IN LIQUIDS BY THE DIFFRACTION MICROMETHOD AND CERTAIN THEORETICAL PROBLEMS. G. M. Pantchenkov. Translated by K. S. Bevis (Savannah River Lab.) from J. chim. phys. 54, 931-7(1957). 15p.

An apparatus was constructed for measuring the coefficients and kinetics of diffusion in liquids by means of the Fresnel diffraction. The method for using this apparatus and the calculation of the diffusion coefficients are described. In order to calculate the coefficients in liquids, theoretical formulas are given which show the relation between the diffusion coefficients and the temperature, concentration, and pressure. Good agreement was obtained between experiment and the formula which gives the relation between the diffusion coefficients and the temperature. The simple exponential relation between the diffusion coefficients and the temperature has been shown to be approximate. (auth)

16192 AEC-tr-3382
ON SOLUTIONS OF METALLIC CADMIUM IN MOLTEN CHLORIDES. S. Karpachev and A. Stromberg. Translated for Atomics International from Zhur. Fiz. Khim. 13, 397-405(1939). 12p. (Figures omitted).

In melted mixtures containing chlorides of potassium, sodium, and cadmium, the dependence of the potential of the carbon electrode on the concentration of the metallic cadmium dissolved in molten salts was investigated. It was found that, depending on the concentration of the dissolved metal, the potential of the carbon electrode varies according to the usual thermodynamic equation. The dependence of the solubility of the metallic cadmium in molten mixtures of chlorides of potassium and sodium with cadmium chloride on the content of the latter was studied. (auth)

16193 AEC-tr-3387
INTERMEDIATE STAGES OF THE REACTIONS IN THE FORMATION OF CARBIDES OF TITANIUM, ZIRCONIUM, VANADIUM, NIOBIUM AND TANTALUM. G. V. Samsonov. Translated by Michael Roman (Westinghouse Electric Corp. Bettis Atomic Power Div.) from Ukrain. Khim. Zhur. 23, 287-96(1956). 19p.

The tensimetric investigation of the formation of the carbides TiC, ZrC, VC, NbC, and TaC was conducted in a vacuum according to the general reaction $Me_xO_g + zC = Me_xC_{z-y} + yCO$. During the roentgen and chemical analysis of intermediate and final products, and also during the calculation of the approximate values of the heats of their formation, the passage of the reactions for obtaining TiC and ZrC through the stages of the intermediate oxides, Ti_2O_3, Ti_3O_5, TiO, and Zr_2O_3, ZrO, was confirmed. Also evident was the passage of the reactions of formation of the carbides of vanadium (from the charge $V_2O_3 + 5C$), of niobium, and of tantalum (from the charges $Nb_2O_5 + 7C$ and $Ta_2O_5 + 7C$) through the stages of the intermediate oxides, VO, V_4O and TaO_2, Ta_4O. The presence of intermediate oxides of zirconium, Zr_2O_3 and ZrO, was shown to be similar to the corresponding oxides Ti_2O_3 and TiO, and it was previously established that ZrO has a cubic face-centered lattice with a spacing $a = 4.62$ A. The more clearly defined conditions of deriving in a vacuum the carbides of niobium and tantalum correspond most closely, according to composition, to the formulas NbC and TaC. The values of ΔH for the oxides were determined. (auth)

16194 NP-tr-131
REDUCTION AND DISSOCIATION OF OXIDES OF COBALT AND NICKEL. G. I. Chufarov, M. G. Zhuravleva, and E. P. Tatievskaya. Translated by M. C. Wheeler (U.K.A.E.A. Atomic Energy Research Establishment) from Doklady Akad. Nauk S.S.S.R. 73, 1209-12(1950). 8p.

The dissociation and kinetics of the reduction of the oxides of Co and Ni by H_2 were investigated. The results indicated that oxides of Ni and Co, while they differ sharply in respect to oxygen equilibrium pressures in dissociation, have similar reduction speeds, as determined by activation energy values and by reaction surface. (J.R.D.)

16195 NP-tr-132
RETARDING ACTION OF GASEOUS REACTION PRODUCTS ON THE RATE OF REDUCTION OF MANGANESE OXIDES BY HYDROGEN AND CARBON MONOXIDE. G. I. Chufarov, B. D. Averbuch, E. P. Tatievskaya, and V. K. Antonov. Translated by J. M. Crabtree (U.K.A.E.A. Atomic Energy Research Establishment) from Zhur. Fiz. Khim. 26, 834-41 (1952). 10p. (Figures omitted).

Adsorption measurements for the reducing gases (CO and H_2) and for the gaseous reaction products (H_2O and CO_2) on the reaction surfaces of manganese oxides are compared with kinetic data on reduction with pure gases and in the presence of gaseous reaction products. Results indicate that gaseous reaction products adsorbing on the reaction surface lower the reduction rate. The inhibiting rate of CO_2 can be quantitatively estimated, and the reduction rates agree with data from absorption measurements on the reaction surfaces of these oxides. (J.R.D.)

16196 NP-tr-133
RATE OF REDUCTION OF MANGANESE OXIDES BY HYDROGEN AND BY CARBON MONOXIDE. E. P. Tatievskaya, V. K. Antonov, and G. M. Chufarov.

Translated by R. C. Murray (U.K.A.E.A. Atomic Energy Research Establishment) from Doklady Akad. Nauk S.S.S.R. 68, 561-4(1949). 5p.

The rates of reduction of MnO_2, Mn_2O_3, and Mn_3O_4 by CO are reported and compared to the reduction rates of these compounds in H_2. The MnO_2 is reduced considerably faster by CO than by H_2. The Mn_2O_3 is reduced more rapidly by CO than by H_2 at low percentage reductions, whereas the reverse is true at greater than 40% reduction. The Mn_3O_4 is reduced more slowly by CO than by H_2. (J.R.D.)

16197

OXIDATION OF METALS: DETERMINATION OF ACTIVATION ENERGIES. Per Kofstad (Central Inst. for Industrial Research, Blindern, Oslo). Acta Chem. Scand. 12, 701-7(1958).

A new method is proposed for the determination of energies of activation of oxidation of metals and alloys. Metals are oxidized under conditions of linearly increasing temperature, and the activation energy may be determined from one single oxidation run. In addition the method also gives the approximate temperature regions in which different rate laws of oxidation are found. The described method has been applied to high-temperature oxidation of nickel, zirconium, copper, and titanium. (auth)

16198

THE EFFECTIVENESS OF SAND AS A FILTER MEDIUM. R. E. Yoder and F. M. Empson (Oak Ridge National Lab., Tenn.). Am. Ind. Hyg. Assoc. J. 19, 107-10(1958) Apr.

Sand fillers were studied under a variety of conditions to determine their usefulness as a filter medium for aerosols in low-velocity air streams. Ruthenium and iodine were removed from the vapor stream from a boiling mixture containing these isotopes, and it is thought that sand may be used to filter aerosols from either dry or moist gas streams. (J.R.D.)

16199

THE METHODS FOR MARKING ORGANIC COMPOUNDS WITH RADIOCARBON. G. Billek (Univ. of Vienna). Atompraxis 4, 270-3(1958). (In German)

The properties of radiocarbon and the basis of its use as a tracer isotope in organic chemistry are briefly discussed. The production of compounds labeled with radiocarbon necessitates a special technique, which must be adapted to the extremely small quantities of the substance which are often required. Here certain devices are suggested which can be constructed with simple equipment. In order to get a high yield for the isotope, modifications of the synthesis process are sometimes unavoidable. General principles are illustrated by means of special syntheses, and the question of the clearness of the labeling is also treated. In conclusion, the self-decomposition of compounds labeled with radiocarbon is pointed out, together with the necessity of testing for purity and means of doing this. (auth)

16200

THE PREPARATION OF SOME MIXED HALOGENIDES OF NIOBIUM AND TANTALUM. Marcel Chaigneau. Compt. rend. 247, 300-2(1958) July 21. (In French)

The preparation of the mixed halides of niobium and of tantalum was studied. Niobium pentoxide was heated with aluminum bromide and aluminum iodide in proportions of 1 mole of bromide for 2 moles of iodide and also in the reverse proportions at 230°C for 24 hours. The only compound formed was isolated by sublimation in a vacuum at 350°C. It was a black acicular crystal with a density of 4.68 at 18°C and had the formula $NbBrI_2$. Tantalum pentoxide heated with one mole of AlI_3 and two moles of $AlBr_3$ at 230°C for 48 hours gave a black crystal which could be separated by sublimation at 350°C in the form of triangular tables with mordore reflections presenting in some places efflorescences. The density is 5.47 at 18°C and the formula is $TaBr_4I$. If the pentoxide is heated with one mole of $AlBr_3$ and two moles of AlI_3, a dark brown crystal is formed with a density of 5.85 at 18°C. Its formula is $TaBrI_4$. The mixed halides are instable in air and are attacked by water, ammonia, and dilute acids. Niobium bromoiodide is insoluble in the usual organic solvents. Tantalum bromoiodides are insoluble in ether, carbon sulfide, and carbon tetrachloride, but are soluble in acetone, ethyl and methyl alcohols, dioxane, and glycerine. (J.S.R.)

16201

EFFECT OF THE CONCENTRATION OF VARIOUS SALTS ON THE DISSOLUTION OF CADMIUM IN AIR-SATURATED SOLUTIONS. Charles J. Boone (American Viscose Corp., Marcus Hook, Penna.) and Cecil C. Lynch (Univ. of Delaware, Newark). Corrosion 14, 409t-11t(1958) Sept.

The initial rate of dissolution of cadmium in various concentrations of carbon dioxide-free, air-saturated, neutral salt solutions at 25°C was examined polarographically. The salts employed were potassium chloride, sodium chloride, barium chloride, potassium bromide, sodium bromide, potassium iodide, sodium iodide, sodium perchlorate, and barium perchlorate. The experiments were conducted in such a manner that the only variable was the concentration of salt in the solutions. The order of reaction due to the salt was calculated at 25°C for the initial rate of dissolution of cadmium for each of the above salts. The nature of the anion was shown to have a much greater effect on the rate than does the nature of the cation. The perchlorate ion appears to act as an inhibitor and the iodide salts to have a maximum in the corrosion rate versus concentration curves. These results may be explained on the basis of anion polarization. (auth)

16202

PROCESS FOR THE PURIFICATION OF SOLUTIONS OF PLUTONIUM NITRATE AND PREPARATION OF THE METAL. S. Chambers and T.-G. Hughes. Energie nucléaire 2, 202-6(1958) July-Sept. (In French)

The solution of plutonium nitrate, separated by extraction with dibutyl glycol from the solution of fuel elements, is concentrated by evaporation and purified by extraction with a mixture of tributyl phosphate and kerosene. The residual impurities coming from the reagents and the apparatus can be eliminated by a second purification in glass apparatus. The nitrate solution is concentrated. The nitrate is transformed to the oxide, then to the fluoride, and finally to the metal by Ca or Mg reduction. The impurities, which represent less than 1% by weight, are iron, nickel, chromium, and uranium. The construction of an installation for this process is briefly described. (tr-auth)

16203

ON THE ANALOGY BETWEEN CARCINOGENIC COMPOUNDS AND PLANT GROWTH COMPOUNDS IN THE MECHANISM OF THEIR BIOLOGICAL ACTIONS. Kenichi Fukui, Chikayoshi Nagata, and Teijiro Yonezawa (Kyoto Univ.). Gann 49, 43-8(1958) Mar.

The correlation between the electronic structure and the auxin activity of plant growth compounds is discussed. The strong resemblance between the carcinogenic compounds such as polycondensed aromatic hydrocarbons and plant growth compounds such benzoic acid derivatives is pointed out and its meaning is discussed. (auth)

16204

THE KINETICS OF THE HYDROLYSIS OF TRIMETHYLENE OXIDE IN WATER, DEUTERIUM OXIDE AND 40% AQUEOUS DIOXANE. J. G. Pritchard and F. A. Long (Cornell Univ., Ithaca, N. Y.). J. Am. Chem. Soc. 80, 4162-5(1958) Aug. 20.

The rate-ratio for hydrolysis of trimethylene oxide in 1.5 M deuterosulfuric and sulfuric acids is $k^D/k^H = 2.2$. The rates of hydrolysis in solutions of from 0.4 to 3 M perchloric acid in both water and 40% aqueous dioxane are proportional to the h_0 acidity function in each solvent, the slopes of log k_1 vs. $-H_0$ plots being 1.00 and 0.80, respectively. These facts support an acid-catalyzed hydrolysis mechanism characterized by a preliminary equilibrium between trimethylene oxide and hydronium ion to form the conjugate acid followed by a rate-determining rearrangement of this species to give a highly reactive carbonium ion. Base-catalyzed and neutral hydrolysis reactions of trimethylene oxide are extremely slow. (auth)

16205

HYDROLYSIS AND OLATION OF Th(IV) CHELATES OF POLYAMINOPOLYCARBOXYLIC ACIDS. Raymond F. Bogucki and Arthur E. Martell (Clark Univ., Worcester, Mass.). J. Am. Chem. Soc. 80, 4170-4(1958) Aug. 20.

The ethylenediaminetetraacetate and the 1,2-diaminocyclohexanetetraacetate chelates of Th(IV) were found to form binuclear diolate chelates in aqueous solution. Through measurement of the influence of concentration on the potentiometric titration curves, the acid dissociation constants of the normal chelate compounds and the dimerization constants of the hydrolysis products were determined. The Th(IV) chelate of heptadentate or octadentate diethylenetriaminepentaacetic acid forms a completely coördinated, monohydroxo chelate which shows no tendency to form polynuclear substances. (auth)

16206

DIFFUSION AND HOT RADICAL KINETICS IN THE PHOTOLYSIS OF METHYL IODIDE IN CYCLOHEXANE. Roswell F. Pottie, William H. Hamill, and Russell R. Williams, Jr. (Univ. of Notre Dame, Ind.). J. Am. Chem. Soc. 80, 4224-30(1958) Aug. 20.

Solutions of methyl iodide in cyclohexane were photolyzed at 2537 A. Products and their quantum yields were: methane 0.190, cyclohexyl iodide 0.085, cyclohexene 0.057, iodine 0.048, hydrogen iodide 0.009. Methane is attributed to reaction of hot methyl radicals with solvent and to reaction of thermal methyl radicals with hydrogen iodide. Cyclohexene is attributed to a diffusion controlled reaction between cyclohexyl radicals and iodine atoms which remain in proximity after the hot reaction. Hydrogen iodide is twice as effective as iodine in reacting with methyl radicals. Recombination of methyl radical–iodine atom pairs following dissociation varies exponentially with the square root of hydrogen iodide concentration, indicating a diffusion-controlled process. (auth)

16207

THE PREPARATION OF CADMIUM NIOBATE BY AN ANODIC SPARK REACTION. William McNeill (Frankford Arsenal, Philadelphia). J. Electrochem. Soc. 105, 544-7(1958) Sept.

A new method of preparing cadmium niobate was demonstrated. This method involved the anodic spark reaction of cadmium in a niobate solution and crystallization of the anode product by heating at 650°C. The crystallized anode product was made into a solid wafer by pressing it at 350,000 psi, and electrical measurements were made. Even though there was some evidence of impurity or porosity in the sample, a dielectric constant of about 600 was found at room temperature. It is believed that anodic spark reactions might be employed to prepare a wide variety of complex oxides and possibly other compounds. (auth)

16208

TRANSPORT NUMBERS OF THE PURE FUSED SALTS, $LiNO_3$, $NaNO_3$, KNO_3, AND $AgNO_3$. Frederick R. Duke and Boone Owens (Iowa State Coll., Ames). J. Electrochem Soc. 105, 548-9(1958) Sept.

The transport experiments were done in a cell in which the electrodes were of solid Ag surrounded by molten $AgNO_3$. When studying salts other than $AgNO_3$, cells were used which contained a capillary constriction between the alkali nitrate which filled the upper portion of the cell and the $AgNO_3$ at the bottom in contact with the Ag. Transport numbers and equivalent conductances of the ions and salts are tabulated, in addition to experimental and calculated transport numbers. (J.R.D.)

16209

THE CATALYTIC HYDROGEN REDUCTION AND DEUTERIUM EXCHANGE OF CYCLOPENTANONE ON EVAPORATED METAL FILMS AND SOME OBSERVATIONS ON CYCLOHEXANONE. C. Kemball and C. T. H. Stoddart (Queen's Univ. of Belfast). Proc. Roy. Soc. (London) A246, 521-38(1958) Aug. 26.

Some catalytic reactions of cyclopentanone vapor with hydrogen and with deuterium on evaporated metal films in a static system were followed by means of a mass spectrometer. Hydrogenation to cyclopentanol and hydrogenolysis with formation of cyclopentane and cyclopentene were observed to different extents on films of rhodium, palladium, platinum, tungsten, and nickel. Kinetic data, activation energies, and frequency factors were obtained for these reduction processes and possible mechanisms are discussed. Similar information was obtained for the exchange reactions. An order of activity of the metals for inducing fission of the C–O bond is given. Preliminary experiments with cyclohexanone indicated an analogous behavior to that found for cyclopentanone. A comparison is drawn between the reactions of the cyclic ketones and those found for acetone. (auth)

16210

THE CHARACTERISTICS OF ζ-POTENTIAL AGAINST CONCENTRATION RELATIONS. P. J. Anderson (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Trans. Faraday Soc. 54, 562-72(1958) Apr.

On the assumption that the diffuse double layer theory allows surface charge densities to be calculated from electrokinetic data, relations have been derived from which $d\zeta/d \log_{10}C$ may be determined for various cases involving ideal localized adsorption processes. It is shown that the localized adsorption model explains the fact that many ζ against $\log_{10}C$ relations exhibit maxima and that the gradients of such curves are usually considerably less than the Nernst value (2.3 kT/Ze where the symbols have their usual significance). A comparison between the model and a number of experimental results is considered. (auth)

16211

THE STUDY OF THE PASSIVITY OF METALS IN INHIBITOR SOLUTIONS, USING RADIOACTIVE TRACERS. PART I. THE ACTION OF NEUTRAL CHROMATES ON IRON AND STEEL. D. M. Brasher and A. H. Kingsbury, (Chemical Research Lab., Teddington, Middlesex, Eng.). Trans. Faraday Soc. 54, 1214-22(1958) Aug.

Using potassium chromate labeled with Cr^{51}, it has

been shown that, during immersion of steel in chromate solution, logarithmic growth of an oxide film, containing chromic and iron oxides, proceeds in a manner similar to that of oxide film growth in air. The work also indicates the presence of an adsorbed Cr-containing layer. It is concluded that inhibition is maintained as long as the concentration of chromate ions in the solution (or the presence of the adsorbed layer) can sustain uninterrupted and orderly (logarithmic) growth of the oxide film. The work has also demonstrated the logarithmic growth of the oxide film on steel in air at room temperature. (auth)

16212

STUDIES OF THE CATHODIC PROCESS DURING THE ELECTROLYSIS OF THE PURE MOLTEN CHLORIDES OF CALCIUM, SODIUM AND POTASSIUM. L. Suski. Zhur. Fiz. Khim. 32, 1393-1403(1958). (In Russian)

Tests were made in order to determine the formation of subcompounds in molten salts. The subcompounds are formed as the result of reaction between the metal and its molten salt. In the light of this the polarization curves of a ferrous microelectrode immersed in pure, molten calcium, sodium, and potassium chlorides were studied. Curves obtained from salts containing no dissolved metal (not subjected to electrolysis before) were compared with those from salts containing metal dissolved during previous electrolysis. The emf's of the cells $Cs_{(s)}/CaCl_2/Cl_2$ and $Na_l/NaCl/Cl_2$ were also measured. The results obtained showed that in molten $CaCl_2$, Ca^+ ions are being formed. This is in agreement with recently published results of experiments with a cryolite bath. From the polarization curves it follows that at this temperature some quantities of sodium are evolved in the gaseous phase. (tr-auth)

Analytical Procedures

16213 AECU-3821

Michigan. Univ., Ann Arbor.

THE POLAROGRAPHIC DIFFUSION CURRENT: CURRENT-TIME RELATIONSHIP AT THE DROPPING MERCURY ELECTRODE. Report No. 37. Joseph M. Markowitz and Philip J. Elving. July 24, 1958. 68p. Project No. 8. Contract AT(11-1)-70. $10.80(ph OTS); $3.90(mf OTS).

A critical review is presented of the fundamental polarographic problem concerning the disparity between present theory and experiment in the current-time relationship at the dropping mercury electrode. The theory of the current at the dropping mercury electrode has passed through a series of developments each more sophisticated than the last, culminating in the work of Matsuda who has carried the mathematical part of the theory to a point of great rigor, and whose method is capable of extension (at the cost of computational labor) to any degree of accuracy. A detailed and critical analysis has been made of the mathematical contributions of different authors to the analysis of the problem. A striking feature of these theoretical studies is the close similarity of the equations for the current as derived by diverse approaches, some of which are shown to be seriously in error. At the same time, the concentration functions derived by the various authors, from which the surface flux and current are calculated, have differed greatly. The results of the theoretical treatments have been compared to the best available experimental description of the current-time relation. The general conclusion reached is that the experimentally observed current-time relationship in polarography cannot be explained by the simple hypothesis, common to all previous mathematical work, that constant initial solution concentration exists at the time when each drop begins to form. The postulatory basis of the theory was therefore revised to contain the alternate hypothesis that at the beginning of drop formation the region about the electrode tip is depleted of electroactive material because of its removal by electrolysis at the preceding drop. (auth)

16214 AERE-C/M-145

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

SOME NOTES ON AN ATTEMPT TO USE T.T.A. IN CONJUNCTION WITH CHROMATOGRAPHY FOR THE SEPARATION OF RARE EARTHS. F. W. Cornish. 1957. Date of MS. June 1952. 12p. $0.54(BIS).

The use of thenoyltrifluoroacetone for the chromatographic separation of terbium and europium was studied. Experimental aspects of the technique are discussed. (J.E.D.)

16215 AERE-C/R-2456

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.

THE SPECTROGRAPHIC DETERMINATION OF MAGNESIUM IN BISMUTH-URANIUM ALLOYS. J. C. Cotterill. June 1958. 8p. $0.32(BIS).

The bismuth alloys are converted to oxide and mixed with a spectrographic buffer containing ferric sulfate. Pellets of this mixture are excited in the d-c arc using copper electrodes, and spectra are evaluated by microphotometry using iron as internal standard. The effective concentration range is 50 to 70 ppm. The coefficient of variation for single spectra is 5% at the 300 ppm level. (auth)

16216 APEX-405

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

POLAROGRAPHY OF EUROPIUM AND YTTERBIUM. James O. Hibbits, Mary R. Menke, and Warren F. Davis. Aug. 11, 1958. 19p. Contracts AF33(038)-21102 and AT(11-1)-171. $0.75(OTS).

The polarographic determination of individual rare earths in a mixture of these elements, in most cases is difficult, if not impossible, because most of the rare earths are reduced at approximately the same potential and interfere with each other. However, europium and ytterbium are reduced at more positive potentials and can be determined without interference from each other or from the other rare earths. The purpose of this investigation was to determine the polarographic behavior of europium and ytterbium in several different supporting electrolytes. This investigation was carried out with lithium chloride, ammonium chloride, and tetramethyl ammonium bromide. The wave characteristics and data for diffusion-current constants were determined for europium and ytterbium in these supporting electroytes. (auth)

16217 BLG-22

Brussels. Centre D'Étude de l'Énergie Nucléaire.

ANALYSE VOLUMETRIQUE DES ALLIAGES URANIUM-ALUMINIUM. (Volumetric Analysis of Uranium-Aluminum Alloys.) Ph. Mechelynck and P. De Conde. July 3, 1958. 13p.

A comparison between the different volumetric methods of determining uranium is made. An original method, based on the reduction of uranium by an aluminum plate is described. It is fast and simple. The accuracy is of the order of 0.5%. (auth)

16218 HW-54438

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

AMERICIUM ANALYSIS BY GAMMA ABSORPTIOMETRY. R. E. Connally, U. L. Upson, P. E. Brown, and F. P. Brauer. May 20, 1958. 28p. Contract W-31-109-Eng-52. $0.75(OTS).

The major advantages of the absorptiometer as compared to the x-ray photometer are the dependability and simplicity of the source, essentially monochromatic emission, and low cost. The Am^{241} gamma absorptiometer is limited to special applications as compared to the general purpose x-ray photometer. For example, the Am^{241} absorptiometer has a 1.5% standard deviation at 5 g/l, compared to 0.7% for the x-ray photometer. Also the x-ray photometer can tolerate 10^7 times greater sample gamma activity before a 1% error would be induced at 5 g/l uranium. On the other hand, the Am^{241} gamma absorptiometer has a very real advantage where an additional analytical instrument is needed in the laboratory or operating plant to couple closely with an experiment or process. The cost of the gamma absorptiometer is relatively low. The gamma absorptiometric technique has found application in the plant and the laboratory, where its limitations were not serious and its simplicity advantageous. (auth)

16219 IGO-AM/W-176

United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England.

THE DETERMINATION OF BORON IN GASEOUS CARBON DIOXIDE. 1958. 10p. $0.36(BIS).

The gas sample is absorbed in sodium hydroxide, and boron is separated by distillation as methyl borate and collection in a mixed glycerol/sodium reagent. The distillate is evaporated to dryness, and boron in the ignited residue is determined absorptiometrically using curcumin in the presence of oxalic and hydrochloric acids. The method is suitable for the determination of boron in the coolant gas of nuclear reactors of the Calder Hall type. Nitrates and perchlorates, if present in the methanol distillate, will interfere with the absorptiometric procedure. (auth)

16220 LA-1858(2nd Ed.)

Los Alamos Scientific Lab., N. Mex.

ANALYTICAL PROCEDURES OF THE INDUSTRIAL HYGIENE GROUP. M. F. Milligan, E. E. Campbell, B. C. Eutsler, Jean McClelland, and W. D. Moss. Aug. 1958. 261p. Contract W-7405-eng-36. $4.00(OTS).

A collection of analytical methods used by the Industrial Hygiene Group at the Los Alamos Scientific Laboratory is presented. (W.L.H.)

16221 NP-5664(Pt. II)

Metallurgical Advisory Committee on Titanium.

RECOMMENDED METHODS OF THE PANEL ON METHODS OF ANALYSIS. INFORMATION BULLETIN NO. T8, PART II. Sept. 11, 1958. 65p.

Methods are presented for the determination of carbon, chloride, magnesium, oxygen, hydrogen, silicon, tungsten, and boron in titanium and titanium alloys. (W.L.H.)

16222 RFP-84

Dow Chemical Co. Rocky Flats Plant, Denver.

AN ISOTOPIC DILUTION METHOD FOR ASSAYING ENRICHED URANIUM METAL SAMPLES USING THE MASS SPECTROMETER. K. B. Earnshaw and R. H. Roberts. Oct. 3, 1957. 14p. Contract AT(29-1)-1106. $3.30(ph OTS); $2.40(mf OTS).

An isotopic dilution method for the assay of uranium metal using the mass spectrometer was devised. The total impurities in the metal can be determined within X% ± 0.07 in the 0 to 50% range. The results of analysis of five metal samples by this method are included. (auth)

16223 TID-7555

Oak Ridge National Lab., Tenn.

FIRST CONFERENCE — ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY, NOVEMBER 4-6, 1957, GATLINBURG, TENNESSEE. C. D. Susano, H. S. House, and Margaret A. Marler, eds. June 1958. 261p. $3.50(OTS).

Seventeen review papers presented at the conference are compiled. Abstracts of the other four are included. The papers set forth recent advances in methods for analysis of reactor construction materials, fuels, moderators, coolants, and blanket materials. Separate abstracts have been prepared for each paper. (T.R.H.)

16224 TID-7555(p.1-5)

National Carbon Co., New York.

THE ROLE OF ANALYTICAL CHEMISTRY IN THE FIELD OF ATOMIC ENERGY. C. E. Larson. p.1-5 [of] FIRST CONFERENCE — ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY, NOVEMBER 4-6, 1957, GATLINBURG, TENNESSEE. 5p.

The role of analytical chemistry in the development of atomic energy from its very beginning is emphasized. The effect atomic energy has had on developments in analytical chemistry is discussed, and the future role of analytical chemists in nuclear technology is outlined. (T.R.H.)

16225 TID-7555(p.6-23)

Oak Ridge National Lab., Tenn.

THE ROLE OF THE ANALYTICAL CHEMIST IN THE DEVELOPMENT OF POWER REACTORS. R. B. Briggs. p.6-23 [of] FIRST CONFERENCE — ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY, NOVEMBER 4-6, 1957, GATLINBURG, TENNESSEE. 18p.

The analytical chemist, together with the metallurgist, metallographer, microscopist, and research man, plays a highly important role in the development of power reactors. These specialists determine the composition and properties of the materials of construction, fuel solutions, and thorium oxide slurries for use as blanket material in homogeneous reactors. During the development stage, numerous minor components of fuel solutions and slurries of thorium oxide under test must be determined by chemical analysis in order to establish the rate of corrosion of reactor components, indicate chemical or physical changes within the solutions and slurries, and provide other data required by the design engineer. Similar analyses must also be made after the reactor is placed in operation; however, since the materials for analysis will then be highly radioactive, it was necessary to develop special techniques whereby the analyses can be carried out by remote control in hot laboratories. Illustrations are included of facilities designed for this purpose. Also included are an artist's conception of the Homogeneous Reactor Test and pictures of a number of test facilities used in the development of this reactor. A number of problems encountered in designing the reactor, including those related to selection of the liquid fuel, preparation of slurries of thorium oxide, and circulation of liquid fuels and slurries, are described with particular emphasis on the contributions of the analytical chemist toward solutions of the problems. (auth)

16226 TID-7555(p.24-42)
New Brunswick Area Office, AEC.
ANALYSIS OF URANIUM AND ITS COMPOUNDS. C. J. Rodden. p.24-42 [of] FIRST CONFERENCE — ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY, NOVEMBER 4-6, 1957, GATLINBURG, TENNESSEE. 19p.

Methods are described for the determination of uranium and other major constituents of ores, process materials and uranium alloys and compounds, and for the determination of minor impurities which are present in uranium metal, alloys and compounds. Dissolution procedures for different types of materials, methods for the separation of interferences, limits of detection, and range of applicability are discussed. In addition to an outline of the general principles in the determination of uranium, specific topics considered include: Isotope analysis; determination of elements which absorb neutrons strongly; spectrographic procedures; separation of rare earth elements by ion-exchange; methods for the determination of carbon, nitrogen, oxygen, hydrogen and silicon in uranium metal; methods for the estimation of molybdenum, nickel, chromium, manganese, tungsten, vanadium, silicon, sulfur, and phosphate in UO_3, UF_4, and, in some cases, in other compounds of uranium; fluoride in UF_4; impurities in UF_6 by the freezing point method; and standard materials. 32 references. (auth)

16227 TID-7555(p.43-56)
Oak Ridge National Lab., Tenn.
PROBLEMS IN THE PROCESSING OF RAW MATERIALS FOR URANIUM. C. F. Coleman and K. B. Brown. p.43-56 [of] FIRST CONFERENCE — ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY, NOVEMBER 4-6, 1957, GATLINBURG, TENNESSEE. 14p.

The following topics are discussed principally from the point of view of the process development chemist: What the process development chemist does that requires the services of analytical chemists; what he requires of the analytical chemist; interchanges between process development and analytical chemists. A number of processes which have been developed for the separation of uranium from ores and for the subsequent purification, concentration and conversion of the uranium to U_3O_8 or other compounds are outlined diagrammatically and discussed. Problems associated with the development of these processes are described and the types, quantity, and quality of chemical analyses required in their solution are indicated. The necessity for close liaison between the process and analytical chemist is emphasized. Provisions should be made for interchange not only of chemical information and methods but also of personnel between groups concerned with process development and those carrying out the related chemical analyses. To be most effective, the process chemist must know something of the problems, methods and limitations of analytical chemistry; likewise, the analytical chemists should be cognizant of the problems of the process chemist and the ways in which results of chemical analyses can contribute to their solution. (auth)

16228 TID-7555(p.57-77)
National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.
DETERMINATION OF URANIUM IN ORES, LEACH SOLUTIONS, AND MILL PRODUCTS. M. A. DeSesa. p.57-77 [of] FIRST CONFERENCE — ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY, NOVEMBER 4-6, 1957, GATLINBURG, TENNESSEE. 21p.

Methods in use commercially and also selected methods still under study for the determination of uranium in ores, leach solutions, and mill products are described. These include volumetric, fluorometric and spectrophotometric methods. The most commonly used volumetric method involves the reduction of uranium to uranium(IV) in a Jones reductor and titration to uranium (VI) with dichromate or, less commonly, with ceric sulfate or permanganate solutions, or reduction in a lead reductor and titration with a ceric sulfate solution. A fluorometric method is outlined in detail in which LiF–NaF is used as the flux and fusion is made in a platinum dish. Design characteristics of the fluorometer are set forth. Results are compared with those obtained with somewhat different equipment and a different flux. A thiocyanate spectrophotometric method which is currently widely used, as well as a number of other spectrophotometric methods, is discussed. Solvent extraction and other procedures for removal of interference are given. Finally, polarographic methods, including a method for the simultaneous determination of uranium and vanadium, are considered. (auth)

16229 TID-7555(p.79-114)
Ames Lab., Ames, Iowa.
RECENT DEVELOPMENTS IN THE ANALYTICAL CHEMISTRY OF THORIUM AND ITS COMPOUNDS. Charles V. Banks. p.79-114 [of] FIRST CONFERENCE — ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY, NOVEMBER 4-6, 1957, GATLINBURG, TENNESSEE. 36p.

Methods for the detection, separation and determination of thorium and for the estimation of diverse elements in thorium and compounds of thorium, which have been reported in the literature in recent years, are reviewed. Included are gravimetric, titrimetric, spectrophotometric and polarographic methods. Organic reagents which have been found to be useful in methods for the determination of thorium as precipitation, complexation, chromogenic or indicator reagents are listed with pertinent data relative to their applicability. A bibliography of the analytical chemistry of thorium is presented which consists of 152 references, principally to recent papers and comprehensive reviews of the analytical chemistry of thorium. (auth)

16230 TID-7555(p.116-26)
Nuclear Metals, Inc., Cambridge, Mass.
RECENT DEVELOPMENT IN THE ANALYTICAL CHEMISTRY OF ZIRCONIUM. E. B. Read and F. A. Bauman. p.116-26 [of] FIRST CONFERENCE — ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY, NOVEMBER 4-6, 1957, GATLINBURG, TENNESSEE. 11p.

Methods are described for the determination of zirconium, hafnium and the weight ratio of hafnium to zirconium in metals, compounds, and solutions and also for the estimation of other elements in samples consisting principally of zirconium. Gravimetric, volumetric, colorimetric or spectrophotometric, spectrographic, x-ray fluorescent, and vacuum fusion methods are discussed. (auth)

16231 TID-7555(p.127-37)
Electro Metallurgical Co. Metals Research Lab., Niagara Falls, N. Y.
RECENT DEVELOPMENTS IN THE ANALYTICAL CHEMISTRY OF TITANIUM. Arnold L. Gahler. p.127-37 [of] FIRST CONFERENCE — ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY, NOVEMBER 4-6, 1957, GATLINBURG, TENNESSEE. 11p.

In the commercial preparation of titanium and titanium alloys, 18 elements are currently determined. Of

these, oxygen, hydrogen, nitrogen, carbon, and iron, which adversely affect properties of the alloys, are the most important. Methods for sampling and for the determination of the major impurities as well as many minor components of titanium and titanium alloys are described with particular emphasis on the newer chemical and physical methods of analysis which have been developed within the last two or three years. Comparative test results for two vacuum fusion methods for oxygen are given. Tolerance limits for the principal impurities are set forth and limits of detection are indicated for several elements. In addition, proposed methods for the estimation of a number of elements, which are currently under study, are listed and, in some cases, described briefly. A need for standard reference samples is indicated and efforts toward the preparation of standard samples for hydrogen and oxygen are noted. (auth)

16232 TID-7555(p.138-40)
Columbia National Corp., Pensacola, Fla.
PROBLEMS IN THE PROCESSING OF ZIRCONIUM AND ITS COMPOUNDS. William A. DuPraw. p.138-40 [of] FIRST CONFERENCE—ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY, NOVEMBER 4-6, 1957, GATLINBURG, TENNESSEE. 3p.

A brief summary is given of the functions of an analytical chemistry laboratory in controlling the process variables and product quality in a fully integrated plant for the production of reactor-grade zirconium metal. The process, from zircon sand to "sponge" metal, is described briefly. The requirements with regard to the numbers, types and purposes of the analyses of raw materials, process materials, waste products, purified reagents, and finished product are enumerated and explained. (auth)

16233 TID-7555(p.141-57)
Cramet Inc., Chattanooga.
PROBLEMS IN THE PROCESSING OF TITANIUM AND ITS COMPOUNDS. W. E. Few. p.141-57 [of] FIRST CONFERENCE—ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY, NOVEMBER 4-6, 1957, GATLINBURG, TENNESSEE. 17p.

Industrial methods used in the production of titanium sponge, formation of titanium and alloy ingots from the sponge, and fabrication of mill products are discussed. Flow sheets outlining the sequence of operations are provided. Sampling procedures, tolerance limits for the principal impurities (oxygen, hydrogen, nitrogen, and carbon), methods of chemical analysis which are used to estimate these impurities, and the deleterious effects caused by each impurity are described briefly. Finally, tables listing the physical properties of mill products from various process stages of titanium production are included. (auth)

16234 TID-7555(p.158-74)
Brush Beryllium Co., Elmore, Ohio.
THE ANALYTICAL CHEMISTRY OF BERYLLIUM. E. Stanley Melick. p.158-74 [of] FIRST CONFERENCE—ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY, NOVEMBER 4-6, 1957, GATLINBURG, TENNESSEE. 17p.

Methods are described for the estimation of beryllium in beryllium ores, process materials, biological and air samples and, also, for the determination of 21 components in beryllium metal and alloys. Gravimetric, volumetric or colorimetric methods are usually employed for the analysis of ores, process materials and biological samples. Fluorometric methods are of particular value for air samples. In the analysis of beryllium metal and alloys, gravimetric, volumetric or colorimetric methods are used to determine: Be, Al, Cr, Cu, Fe, Mg, Mn, Ni, Si, B, C, N, and O. Spectrographic (arc) methods are used for the estimation of: Ag, Co, Cd, Pb, Li, Ca, Zn, and Mo. 78 references. (auth)

16235 TID-7555(p.175-83)
Du Pont de Nemours (E. I.) & Co. Savannah River [Lab., Augusta, Ga.].
ANALYTICAL CONTROL OF HEAVY WATER IN REACTOR MODERATOR SYSTEMS. E. M. Zemyan. p.175-83 [of] FIRST CONFERENCE—ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY, NOVEMBER 4-6, 1957, GATLINBURG, TENNESSEE. 9p.

The impurities commonly determined in deuterium oxide which is used as a moderator in reactors include protium oxide, that is, light water, and cationic impurities, including radioactive nuclides. Also, tritium oxide must sometimes be determined. The mol per cent of D_2O is most often determined either by methods involving the measurement of density or by mass spectrometry. Two density methods, the pycnometer and temperature-float methods, are discussed in some detail as is the mass spectrometric procedure. A beta counting technique, employing an ion chamber, is used to estimate the tritium oxide concentration. Cationic impurities are concentrated by evaporation or other suitable means and then determined by emission spectrographic methods. Counting techniques are also used to estimate the concentration of radioactive nuclides, following their separation by chemical means. A separation scheme is included. (auth)

16236 TID-7555(p.184-91)
Oak Ridge National Lab., Tenn.
ANALYSIS OF REACTOR-GRADE GRAPHITE. H. G. MacPherson. p.184-91 [of] FIRST CONFERENCE—ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY, NOVEMBER 4-6, 1957, GATLINBURG, TENNESSEE. 8p.

Methods are discussed which have been found applicable for the determination of impurities in reactor-grade graphite and in raw materials which are used in the preparation of graphite. Sampling techniques and procedures for processing samples are described in some detail. Comparative test results for boron as determined in a number of laboratories are set forth and the necessity for careful standardization of sampling, processing, and analytical procedures is emphasized. (auth)

16237 TID-7555(p.192-215)
Oak Ridge National Lab., Tenn.
THE DETERMINATION OF TRACE ELEMENTS IN REACTOR MATERIALS BY THE METHODS OF NEUTRON ACTIVATION ANALYSIS. G. W. Leddicotte, W. T. Mullins, L. C. Bate, and J. F. Emery. p.192-215 [of] FIRST CONFERENCE—ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY, NOVEMBER 4-6, 1957, GATLINBURG, TENNESSEE. 24p.

Neutron activation analysis is used to determine trace elements in such reactor materials as ores, structural materials, cooling water and moderators. In these particular applications, microgram and submicrogram quantities of many different elements have been determined, thus showing that neutron activation is a sensitive method of analysis. The principles of these methods are discussed, and additional information is given on

specific application of radiochemical methods and gamma spectrometry in this work. (auth)

16238 TID-7555(p.216-26)
Naval Research Lab., Washington, D. C.
X-RAY METHODS OF ANALYSIS. L. S. Birks. p.216-26 [of] FIRST CONFERENCE—ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY, NOVEMBER 4-6, 1957, GATLINBURG, TENNESSEE. 11p.

Methods used in x-ray spectroscopy are described, and some examples are given which indicate the limits of detection and accuracy attainable by x-ray spectroscopy under various conditions. The new electron probe equipment, which is useful for the analysis of samples as small as one cubic micron, is also briefly discussed; the optical system of the electron probe is diagramed and applications are cited. (auth)

16239 TID-7555(p.227-38)
Oak Ridge National Lab., Tenn.
SPECTROCHEMICAL ANALYSIS OF REACTOR MATERIALS. Cyrus Feldman. p.227-38 [of] FIRST CONFERENCE—ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY, NOVEMBER 4-6, 1957, GATLINBURG, TENNESSEE. 12p.

Spectrochemical methods are presented for the analysis of uraniferous ores, reactor materials, and radioactive samples. These methods are of particular value in the field of nuclear reactor technology because, through their application, more information about sample composition can be obtained more quickly than by any other means. Topics discussed in the application of spectroscopy to the estimation of uranium and, especially, of minor components in ores and reactor materials include: Preparation of the sample for excitation in an arc, the choice and use of internal reference standards, and operating techniques. A carrier distillation technique is described in some detail and results are compared with those obtained through the use of alternate methods. Other methods considered include: the spectrographic estimation of oxygen in metals and the isotope dilution techniques for the determination of hydrogen in metals. Dangers incident to the analysis of radioactive materials and precautions to be taken are discussed. Spectrographic equipment and facilities required to carry out work of this type are described and illustrated. (auth)

16240 TID-7555(p.240-55)
Oak Ridge National Lab., Tenn.
SOLVENT EXTRACTION. J. C. White. p.240-55 [of] FIRST CONFERENCE—ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY, NOVEMBER 4-6, 1957, GATLINBURG, TENNESSEE. 16p.

Organo-nitrogen and organo-phosphorus compounds used as analytical reagents are discussed. Experimental data are cited to show the utility of amines in extracting mineral acids, organic acids, Po, PuO_2^{2+}, Zr, Pa, Th, U, rare earths, and fission products using such compounds as tri-N-benzylamine, methyl-di-N-octylamine, and tri(iso-octyl) amine. The physical properties and extractability of various trialkyl phosphine oxides are tabulated, graphed, and discussed. (T.R.H.)

16241 WAPD-CTA(GLA)-431(Rev.1)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE DETERMINATION OF URANIUM AS AN IMPURITY IN ZIRCONIUM AND ZIRCALOY. D. L. Smith, H. R. Wilson, and G. W. Goward. July 7, 1958. 5p. $1.80 (ph OTS); $1.80(mf OTS).

A method for determination of uranium in Zircaloy and zirconium in the range 0.25 to 20 ppm on a 1 g sample basis is presented. The samples are dissolved in HF and HNO_3, saturated with $Al(NO_3)_3$, and extracted with diethyl ether. An aliquot is fused with a mixture of NaF and LiF and the fluorescence measured. (J.R.D.)

16242
ACTIVATION ANALYSIS WITH AN ANTIMONY-BERYLLIUM NEUTRON SOURCE. Anil K. De and W. Wayne Meinke (Univ. of Michigan, Ann Arbor). Anal. Chem. 30, 1474-82(1958) Sept.

The potentialities of using a 1- to 5-c antimony-beryllium neutron source for activation analysis were explored. Determinations were made without chemical separation by following the gross decay of the irradiated sample, as well as by gamma spectrum measurements with a manual sweep, and an automatic sweep spectrometer. More than 12 elements were studied, alone and in mixtures. A simple irradiation chamber coupled with simple manipulations permits routing handling of the source with safety. Sensitivity values for many elements were calculated for this method, using 5-, 15-, and 60-minute irradiation times. Some experimental sensitivity values are also reported. (auth)

16243
CELLULOSE SUPPORTED THORIUM-ALIZARIN RED S REAGENT FOR FLUORIDE ION DETERMINATION. Stanley K. Yasuda and Jack L. Lambert (Kansas State Coll., Manhattan). Anal. Chem. 30, 1485-9(1958) Sept.

The reagent and procedure described are the result of a study of colorimetric methods to produce a color in solution directly proportional to fluoride ion concentration. Fluoride ion in the concentration range to 15 ppm reacts selectively with the reagent to release the thorium—Alizarin Red S chelate (absorption maximum, 520 mμ) into solution. Concentration limits for a number of possible common interfering ions were determined. A polymeric structure for the reagent and a mechanism for the ion exchange reaction are proposed. The combining ratio of thorium to dye was found to be 1 to 2 by gravimetric and spectrophotometric methods. Chelation of thorium through a carbonyl oxygen and the 1-hydroxy group in the Alzarin Red S was substantiated by infrared absorption data. The method should be convenient for rapid visual or spectrophotometric determination of fluoride ion within the conditions specified. (auth)

16244
CONTROLLED POTENTIAL COULOMETRIC DETERMINATION OF URANIUM AND COPPER IN HOMOGENEOUS REACTOR FUELS. L. G. Farrar, P. F. Thomason, and M. T. Kelley (Oak Ridge National Lab., Tenn.). Anal. Chem. 30, 1511-14(1958) Sept.

In order to apply the principle of coulometric analysis to homogeneous reactor fuels, the interferences of a variety of fission and corrosion products were investigated. Essentially complete elimination of interferences is accomplished by combining a simple extraction with a prereduction. This procedure prevents the intereferences of molybdenum^{6+}, chromium^{6+}, copper^{2+}, and antimony^{3+}, and allows the subsequent quantitative determination of uranium. The method can tolerate all the fission elements that would be present after approximately 10% burnup of the fuel. The relative standard deviation is 1%. The concentration of copper^{2+} in the fuel can also be determined, but this determination is less precise and is subject to more interferences than that for uranium. This technique is readily adaptable to remote manipulation and significantly decreases the time involved in the analysis of a complex system. (auth)

16245

A DIRECT FLAME PHOTOMETRIC DETERMINATION OF BORON IN ORGANIC COMPOUNDS. Bruce E. Buell (Union Oil Co. of California, Brea). Anal. Chem. 30, 1514-17(1958) Sept.

A rapid, flame spectrophotometric method was developed for determining boron directly in organic compounds. The method eliminates extractions or distillations of boron usually required by chemical procedures and is suitable for boron contents as low as 0.1%. Accuracy and precision are on the order of 1 to 2% of the amount present. (auth)

16246

DETERMINATION OF FLUORINE IN QUANTITATIVE ORGANIC MICROANALYSIS. T. S. Ma (Brooklyn Coll. of New York City). Anal. Chem. 30, 1557-60(1958) Sept.

Determination of fluorine in organic microanalysis has become increasingly important because of the large number and variety of organic fluoro compounds being synthesized. Because of its peculiar properties, conventional micromethods for halogen determination are not applicable without modification. The principal steps in the determination of fluorine are: decomposition to convert organically bound fluorine to the fluoride ion from ions interfering in the subsequent step, and measurement of the fluoride ion. Methods of decomposition include catalytic oxidation, alkali metal or carbonate fusion, reduction with sodium biphenyl, and heating with concentrated sulfuric acid. Fluoride ion has been separated by the volatility of silicon tetrafluoride, steam distillation of fluorosilicic acid, or ion exchange resin. It has been determined gravimetrically as lead chlorofluoride, volumetrically with sodium hydroxide or thorium nitrate, colorimetrically with ammonium molybdate, and potentiometrically with calcium ions. (auth)

16247

MICRO-PARR BOMB ASSEMBLY SUITABLE FOR MICRODETERMINATION OF FLUORINE IN ORGANIC COMPOUNDS. Al Steyermark and Frank P. Biava (Hoffmann-La Roche Inc., Nutley, N. J.). Anal. Chem. 30, 1579-80(1958) Sept.

For the microdetermination of fluorine in organic compounds, fusion with metallic potassium or sodium in a sealed microbomb at temperatures up to 700°C for periods as great as two hours is recommended. (auth)

16248

EFFECTS OF THE KINETICS OF CHEMICAL REACTIONS ON THE POLARIZATION CURVES. APPLICATION TO THE STUDY OF THE THIOCYANIDE COMPLEXES OF TITANIUM(IV) AND TITANIUM(III). S. Tribalat and D. Delafosse (Centre National de la Recherche Scientifique, Paris). Anal. Chim. Acta 19, 74-89(1958) July. (In French)

The electrochemical oxidation-reduction of the system titanium(IV)–titanium(III) is slow at dropping mercury electrode in perchloric acid or hydrochloric acid, but becomes rapid in the presence of thiocyanate ions. On the basis of polarization curves, interpreted according to a preliminary theoretical study, the authors conclude that the rapid electrochemical reaction is the following: $TiOH \cdot SCN^{+2} + H^+ + e \rightleftharpoons TiSCN^{+2} + H_2O$. An application of the findings to the polarographic determination of titanium is given. (auth)

16249

ACTIVATION ANALYSIS OF VANADIUM IN HIGH ALLOY STEELS USING MANGANESE AS INTERNAL STANDARD. G. Leliaert, J. Hoste, and J. Eeckhaut (Univ. of Ghent). Anal. Chim. Acta 19, 100-7(1958) July.

A method has been developed for the determination of vanadium in high alloy steels by radioactivation analysis. Manganese present in the steel sample is used as an internal standard, thus permitting accurate correction of neutron flux irregularities between sample and reference. The method was tested on 4 National Bureau of Standard samples having a vanadium content from 0.014 up to 2.04% and a widely differing composition as regards other alloy constituents. The results obtained by radioactivation in the Belgian Reactor BR_I and the Amsterdam 28 Mev deuteron cyclotron show satisfactory accuracy as well as precision. (auth)

16250

A NEW METHOD BASED ON PAPER CHROMATOGRAPHY FOR THE ESTIMATION OF THORIUM AND URANIUM IN MONAZITE. I. I. M. Elbeih and M. A. Abou-Elnaga (Univ. of Cairo). Anal. Chim. Acta 19, 123-8(1958) Aug.

A dioxan-antipyrine solvent mixture is used to separate thorium and uranium on sheet chromatograms from the monazite sand solution. Thorium is estimated by an indirect EDTA titration method, using pyrocatechol violet. Uranium is estimated spectrophotometrically by the hydrogen peroxide method. (auth)

16251

ZIRCONYL-ALIZARIN BLUE S COMPLEX; A SPECTROPHOTOMETRIC STUDY. V. Gopalakrishna and Bh. S. V. Raghava Rao (Andhra Univ., Waltair, India). Anal. Chim. Acta 19, 161-5(1958) Aug.

Alizarin blue S in 0.5N hydrochloric acid and 10% acetone gives a colored complex with zirconium salts, which is used for the estimation of zirconium. Measurements were made at 625 mμ and the interference of several cations and anions was studied. (auth)

16252

SOME EXPERIMENTS ON THE POLAROGRAPHY OF PLUTONIUM(VI) IN COMPLEXING MEDIA. G. P. Cook, J. K. Foreman, and E. F. Kemp (U. K. Atomic Energy Authority, Calderbridge, Cumberland, Eng.). Anal. Chim. Acta 19, 174-9(1958) Aug.

Polarographic reduction waves at the dropping mercury electrode have been obtained for plutonium(VI) in several complexing media. In oxalate base solution a reversible wave is obtained corresponding to the reduction of plutonium(VI) to plutonium(V). The non-linear dependence of diffusion current upon plutonium(VI) concentration for this reduction is consistent with the induced disproportionation of plutonium(V) in oxalate solution. (auth)

16253

ASSAY OF TRIBUTYL PHOSPHATE IN ORGANIC SOLVENTS. U. A. Sant and H. Sankar Das (Atomic Energy Establishment, Bombay). Anal. Chim. Acta 19, 202-3 (1958) Aug.

Tributyl phosphate may be determined in organic diluents such as kerosene by low-temperature alkali fusion to inorganic orthophosphate followed by titration with bismuthyl perchlorate. (T.R.H.)

16254

THE CHEMICAL ANALYSIS OF TERNARY ALLOYS OF PLUTONIUM WITH MOLYBDENUM AND URANIUM. G. Phillips, J. Woodhead, and E. N. Jenkins (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Anal. Chim. Acta 19, 229-34(1958) Sept.

It is shown that the absorptiometric determination of molybdenum as thiocyanate may be used in the presence of plutonium. Molybdenum interferes with previously published methods for determining uranium and

plutonium but conditions have been established for its complete removal by solvent extraction of the compound with α-benzoin oxime. The previous methods for uranium and plutonium are satisfactory when applied to the residual aqueous phase following this solvent extraction. (auth)

16255

THE DETERMINATION OF FLUORINE IN RARE EARTH FLUORIDES BY HIGH TEMPERATURE HYDROLYSIS. Charles V. Banks, Keith E. Burke, and Jerome W. O'Laughlin (Iowa State Coll., Ames). Anal. Chim. Acta 19, 239-43(1958) Sept.

The technique of pyrohydrolysis has been applied to the determination of fluorine in the fluorides of scandium, yttrium, and the lanthanons. These fluorides have been divided into two classes according to their rate of hydrolysis. Lutetium, ytterbium, cerium (III), scandium, gadolinium, terbium, dysprosium, holmium, erbium, and thulium fluorides can be hydrolyzed in 30 min or less. Yttrium, lanthanum, praseodymium, neodymium, samarium, and europium fluorides require from 45 to 150 min for complete hydrolysis. Accelerators, such as uranium oxide (U_3O_8), chromium(III) oxide, and a mixture of these oxides have been used successfully to reduce the time required for quantitative hydrolysis of the fluorides in the latter group. The use of the correct accelerator reduces the hydrolysis time to 30 min or less for all these fluorides except lanthanum, praseodymium, and neodymium. (auth)

16256

SPECTROPHOTOMETRIC DETERMINATION OF IRON IN ZIRCONIUM METAL AND IN ZIRCONYL CHLORIDE. Louis Silverman and Katherine Trego (Atomics International, North American Aviation Inc., Canoga Park, Calif.). Anal. Chim. Acta 19, 299-303(1958) Sept.

Iron, present in zirconium metal or in zirconyl chloride, may be determined spectrophotometrically in 1:1 hydrochloric acid solution without prior separation from the zirconium. In a 1:1 hydrochloric acid solution, at the solubility limit of zirconyl chloride (0.28 g zirconium per 25 ml), 20 ppm of iron may be detected. When smaller amounts of iron are to be determined (4 ppm), a larger starting sample (5 g) of zirconium is crystallized from a 3:1 hydrochloric acid solution which reduces the lower limit of detection of iron to 4 ppm. (auth)

16257

COULOMETRIC TITRATION OF ALUMINUM. Reynold T. Iwamoto (Univ. of Kansas, Lawrence). Anal. Chim. Acta 19, 272-6(1958) Sept.

An aqueous ethanol solution ~ 0.005M in 8-quinolinol and 0.04M in sodium sulfate can be used for the coulometric titration of small quantities of aluminum. Samples of aluminum ranging from 5 to 500 μg were successfully titrated with electrolytically generated hydroxyl ions. The end-point was detected by following the apparent pH of the solution. (auth)

16258

THE KINETIC ISOTOPIC EFFECT IN THE REACTION OF HYDROGEN AND TRITIUM WITH SOME METAL OXIDES. V. A. Shushunov and B. J. Andreev (Labachevskii Gor'kii State Univ.). Doklady Akad. Nauk S.S.S.R. 121, 689-92(1958) Aug. 1. (In Russian)

The rate of the topochemical reactions with hydrogen and tritium and the effects of certain factors on the kinetic isotopic effect of these reactions were investigated. Results are given of experiments made on the isotopic effect on the rates of hydrogen and tritium reaction with Ag_2O, Cu_2O, CuO, HgO, PbO_2, and MnO_2 (these react at faster rate with hydrogen) and Mn_3O_4, Mn_2O_3, NiO, CoO, Fe_3O_4, and Fe_2O_3 (the latter react faster with tritium). (R.V.J.)

16259

INDUSTRIAL APPLICATION OF α RADIOACTIVITY IN THE CONTINUOUS DETERMINATION OF URANIUM IN SOLUTION. J.-D. le Franc, P. Pottier, and G. Roux. Énergie nucléaire 2, 195-201(1958) July-Aug. (In French)

A method for the determination of uranium in leaching solutions of uranium minerals by measurement of the α radioactivity of the solutions is described. The method allows the variation of uranium concentration during the recovery of the metal by ion exchange to be followed. The reasons for the choice of α radiation and the factors which interfere in this method are indicated. The application to the recovery of uranium in sulfuric or alkaline solutions is discussed. The apparatus designed for industrial operation is described. (tr-auth)

16260

NEW METHOD FOR X-RAY SPECTRAL INVESTIGATION OF THE CHEMICAL COMPOSITION IN A MICRO-VOLUME OF ALLOY. I. B. Borovskiy and N. P. Il'in. Issledovaniya zharoprochnune splavam. Akad. Nauk SSSR 25-32(1956). (Translated from Referat. Zhur. Fiz. No. 5, 1957, Abstract No. 13150).

An x-ray spectrographic method for the determination of the chemical composition of a substance is described which can be made on volumes of 10 μ^3. In the procedure given elements from 26 to 42 and from 72 to 92 can be determined. A quantitative analysis can be made with an accuracy of 2 to 5% at a sensitivity of 10^{-13} grams. (J.S.R.)

16261

QUANTITATIVE DETERMINATION OF Sr^{90} MIXED WITH OTHER BETA EMITTERS. Giovanna Mayr (Univ. of Milan). Ricerca sci. 28, 1469-72(1958) July. (In Italian)

The amount of Sr^{90} mixed with Y^{90} has been determined by means of a photographic method which can be utilized also in the case of Sr^{90} mixed with another beta emitter isotope as Sr^{89} (auth)

16262

RADIOCARBON DATING UP TO 70,000 YEARS BY ISOTOPIC ENRICHMENT. A. Haring and A. E. de Vries (Laboratorium voor Massaspectografie, Amsterdam) and H. de Vries (Univ. of Groningen, Netherlands). Science 128, 472-3(1958) Aug. 29.

A method is described for the enrichment of CO_2 obtained from original archeological specimens following reduction to CO. The CO enrichment is derived from the O^{18} abundance. For the activity measurements, the enriched CO is oxidized again by leading it over CuO. Enrichment by a factor at 16 takes about 2 months, but shifts the limit of counting to about 70,000 years. Results are reported from measurements on samples of recent carbon dioxide diluted with a known amount of inactive CO^2, dead CO_2 from anthracite, and wood from a well-exposed profile at Amersfoort which was found to have an age of 64,000 ± 1100 years. (C.H.)

16263

PRESENT STATE OF THE ANALYTICAL CHEMISTRY OF BERYLLIUM. V. G. Goryushina. Zavodskaya Lab. 23, 1300-7(1957). (In Russian)

A review is presented of qualitative and quantitative methods for the determination of beryllium. 86 references. (J.S.R.)

16264
THE COMPLEXOMETRIC DETERMINATION OF THORIUM BY MEANS OF 1-(2-PYRIDILAZO)-2-NAPHTHOL AS NATURAL INDICATOR. A. I. Busev, L. V. Kiseleva, and A. I. Cherkesov. Zavodskaya Lab. 24, No. 1, 13-16 (1958).

A complexometric method for the determination of thorium using 1-(2-pyridilazo)-2-naphthol as indicator is described. Other methods using the same reagent are compared, and it is shown that the present method has the greater sensitivity. Lead, mercury, tin, or trivalent iron, bismuth, indium, and vanadium interfere with the method. The iron interference can be removed by the addition of ascorbic acid. Anions which form complexes or precipitates with thorium can also interfere. This method can be used for the analysis of monazite sand. (J.S.R.)

16265
NEW COLOR REACTION FOR THE ASCERTAINMENT AND DETERMINATION OF BERYLLIUM WITH CHROME-BLUE K. L. P. Kalinchenko, N. P. Strakhov, and I. I. Kalinichenko. Zavodskaya Lab. 24, No. 1, 22-3 (1958).

Beryllium ions form a very soluble bright blue compound with the acid chrome-blue K in an ammonia solution at pH 9 to 10. The interference of other ions which might produce colors with K is eliminated by the addition of trilon. In the range of 2×10^{-6} g/ml the color produced follows the Lambert-Beer law. (J.S.R.)

Deuterium and Deuterium Compounds

Refer also to abstract 16235.

16266
SYNTHESIS OF DEUTERATED COMPOUNDS OF BIOLOGICAL INTEREST. N. P. Buu-Hoi and N. Dat Xuong. Compt. rend. 247, 654-6(1958) Aug. 11. (In French)

During an investigation on the possible differences of biological activity between normal organic compounds and their deuterated analogs, pure compounds of hexadeuterated valeric acid, hexadeuterated valeramide, pentadeuterated acetophenone, pentadeuterated 2-phenyl cinchoninic acid, $\alpha \cdot \beta$-diphenyl-β-(pentadeuteriophenyl) ethylene, and α-bromo-$\alpha \cdot \beta$-diphenyl-β-(pentadeuteriophenyl)ethylene were synthesized. (J.S.R.)

16267
THE COEFFICIENTS OF THE EQUILIBRIUM DISTRIBUTION OF DEUTERIUM IN ISOTOPIC EXCHANGE BETWEEN WATER AND SOME THIOLS. K. I. Sakodynskii, S. I. Babkov, and N. M. Zhavoronkov (Karpov Inst. of Physical Chemistry). Doklady Akad. Nauk S.S.S.R. 121, 681-4(1958) Aug. 1. (In Russian)

The equilibrium of deuterium exchange reactions between water and normal butylthiol, secondary butylthiol, isoamylthiol normal hexylthiol, and thiophenol was investigated. It was found that the isotopic equilibrium between the water and thiols is reached in 8 to 10 hr at 20° (in 2 hr in the exchange with thiophenol) and in 2 to 4 hr at 80°. In addition to direct exchange experiments (between deuterium enriched water and thiol with natural deuterium concentration) one reverse exchange experiment was made for each thiol at 20°. For these experiments water with natural concentration of deuterium and thiols was used, enriched, in previous direct exchange experiments, up to ~1%. The experiments confirmed the established thermodynamic equilibrium. (R.V.J.)

Fluorine and Fluorine Compounds

16268
PREPARATION AND THERMAL STABILITY OF LITHIUM TITANIUM FLUORIDE. George J. Janz, Max R. Lorenz, and Charles T. Brown (Rensselaer Polytechnic Inst., Troy, N. Y.). J. Am. Chem. Soc. 80, 4126-8(1958) Aug. 20.

The preparation and properties of Li_2TiF_6 were reinvestigated. After two recrystallizations and high vacuum drying at 200°, 2.57% HF and 0.75% H_2O are still retained, most likely as solvates. When heated in vacuo at 365°, HF and H_2O are removed with little if any decomposition of Li_2TiF_6. At higher temperatures, Li_2TiF_6 undergoes a primary decomposition to form LiF and TiF_4. Thus a sample held under high vacuum at 485° for 21 hr was found to be 42.5% decomposed. When exposed to atmospheric moisture and heated, Li_2TiF_6 decomposes by hydrolysis, with the formation of LiF, TiO_2, and HF. (auth)

16269
THERMODYNAMIC STUDIES AT LOW TEMPERATURES. V. N. Kostryukov, O. P. Samorukov, and P. G. Strelkov (Inst. of Problems in Physics, Moscow). Zhur. Fiz. Khim. 32, 1354-61(1958). (In Russian)

The heat capacities of BF_3, CF_4, and SiF_4 were investigated between 12 to 13°K and the melting points. In the solid state BF_3 reveals no phase transitions. Tetrafluoromethane has a second order phase transition with a jump in the heat capacity at 76.09 ± 0.012°K. The heat effect of the transition is 414.5 cal/mole and the entropy 5.11. Tetrafluorosilane does not reveal any phase transitions in the solid state. The triple points of BF_3, CF_4, and SiF_4 were determined, and corrected for the experimentally determined value of impurity depression. (tr-auth)

Graphite

Refer also to abstract 16236.

16270 CRNE-539
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
THE EFFECTS OF IRRADIATION ON GRAPHITE. G. H. Minchin. Apr. 7, 1953. Decl. Aug. 9, 1955. 23p.

Measurements were made of the thermal conductivity and mechanical properties of unirradiated graphites made from Sarnia and Type R cokes under different conditions. The effect of irradiation in the NRX pile on these properties and on the dimensional changes have been observed over a range of irradiation temperatures. While the irradiations are incomplete, they demonstrate that changes at 450°C irradiation temperature are less than might be expected from annealing data. Low graphitizing temperatures lead to large growths without a corresponding increase of breaking strain so that, from the point of view of growth of the moderator as a whole and the possibility of cracking blocks by differential growth, the highest economical graphitizing temperature should be used and corner blocks from the graphitizing furnace should be placed where the expected damage is small. Some of the phenomena associated with the dimensional changes are explained in terms of the hysteresis effect observed in the mechanical properties. (auth)

16271
INTERFEROMETRIC MEASUREMENT OF THE INTER-

NAL POTENTIAL OF GRAPHITE. Monique Durand, Jean Faget, Jean Ferre, and Charles Fert. Compt. rend. 247, 590-3(1958) Aug. 4. (In French)

The internal potential of graphite was measured using monocrystalline films. The results of the measurements made on films 400 A thick and a potential difference of 75 kv gave the result 11 v. This is in good agreement with previous experimental results and theoretical values. (J.S.R.)

Laboratories and Equipment

16272

THE ARGONNE HIGH LEVEL GAMMA IRRADIATION FACILITY: DESCRIPTION AND OPERATING PROCEDURES. H. Gladys Swop (Argonne National Lab., Lemont, Ill.). Atompraxis 4, 249-54(1958).

The facility is a canal in which spent fuel rods from the Materials Testing Reactor are contained in specially constructed racks, the latter being at the bottom of the canal. The canal is 28 feet long, 14 feet wide, and 24 feet deep. The water level varies from 16 to 20 feet. The water is used as a coolant and shield for the spent fuel rods. The water is demineralized and is continuously recirculated through a mixed bed ion-exchange unit at the rate of 800 gallons per hour. The average temperature of the water is 76°F. There are three underwater irradiation racks in the gamma canal. In the main rack there are twelve fuel rods arranged in the form of a honeycomb, so that there are six sample ports surrounded by four fuel rods and six sample ports adjacent to two fuel rods. Where four fuel rods surround a sample, the sample being four inches in diameter, intensities as high as 3.5×10^6 rads/hr have been obtained. Another rack is a cylindrical one in which a sample as large as 20 inches in diameter and 30 inches high may be irradiated. There are eight fuel rods surrounding this sample cylinder. Due to its large diameter and the fact that the fuel rods in this rack are at least 150 days old, the gamma intensity in the center of this rack may be only 15,000 rads/hr. In the third rack, which is a rectangular one, still older fuel rods are used but the sample cylinders are the same as those used in the main rack, namely $4\frac{5}{8}$" × 28" and when four fuel rods surround a sample the intensity is about 200,000 rads/hr. In this rack the samples do not rotate while in the other two racks they do. Dosimetry is measured by ferrous sulfate solution 0.8 N sulfuric acid. (auth)

16273

INEXPENSIVE, NON-CLOGGING, NON-FREEZING BURET VALVE. Crayton M. Crawford (Los Alamos Scientific Lab., N. Mex.). J. Chem. Educ. 35, 380(1958) Aug.

A simple inexpensive, non-clogging, non-freezing buret valve is described. (C.H.)

16274

ON THE PROBLEM OF THE ORGANIZATION OF LABORATORIES FOR WORK WITH RADIOACTIVE SUBSTANCES. N. I. Leshchinskiy, A. S. Shtan', and V. I. Sinitsyn. Zavodskaya Lab. 23, 1396-8(1957). (In Russian)

A sample plan is given for the design of a laboratory for work with radioactive substances. The precautions to be used in laboratory maintenance and operation are described. (J.S.R.)

Molecular Structure

16275

A DETERMINATION OF THE MOLECULAR WEIGHT OF INSULIN BY RADIATION METHODS. M. S. Volkova, A. M. Tongur, A. S. Chunaeva, and A. G. Pasynskii (Bakh Inst. of Biochemistry, Academy of Sciences of the USSR, Moscow). Biophysics (USSR) (English Translation) 2, 458-61(1958).

The inactivation of crystalline insulin was induced by exposure to x and gamma radiation, and the molecular weight was calculated from the resulting data. (C.H.)

Radiation Chemistry

16276

FORMATION OF ASCORBIC ACIDS BY IONIZING RADIATIONS. B. Coleby. Chem. & Ind. (London) 111-12 (1957) Jan. 26.

Exposure to x rays, gamma rays, or cathode rays in the absence of oxygen induced conversion of aqueous solutions of lactones into their corresponding ascorbic acids. Reaction mechanisms are discussed. (C.H.)

16277

NEUTRON IRRADIATION OF QUINOLINE OXALATE IN THE PRESENCE OF α-NAPHTHOL. Fulvio Cacace and Luciana Cieri (Univ. of Rome). Ricerca sci. 28, 1174-7(1958) June. (In Italian)

The percentage is given of radioactivity of the chemical species insulated in a neutron irradiated mixture of acid quinoline oxalate and α-naphthol. Naphthalene and quinoline containing C^{14} in the ~ ratio which could be expected according to the hypothesis of a statistic substitution were found. The α-naphthol mixed to quinoline salt does not appreciably contribute to the formation of radioactive α-naphthol. (auth)

16278

THE DECOMPOSITION OF AQUEOUS SOLUTIONS OF HYDROXYLAMINE BY γ RAYS. Marc Lefort and Xavier Tarrago. Compt. rend. 247, 454-6(1958) July 28. (In French)

The γ rays of radiocobalt decompose hydroxylamine into ammonia, nitrogen, and hyponitrous acid. In the presence of oxygen some nitrates are formed. Measurement of the initial yields of the products formed permits the determination of the yield in free radicals: $G_H + G_{OH}$ are the result of the radiolysis of water. (tr-auth)

16279

CARBON-14 KINETIC ISOTOPE EFFECTS. III. THE HYDROLYSIS OF 2-CHLORO-2-METHYLPROPANE-2-C^{14}. Myron L. Bender and Gabriel J. Buist (Illinois Inst. of Tech., Chicago). J. Am. Chem. Soc. 80, 4304-7 (1958) Aug. 20.

2-Chloro-2-methylpropane-2-C^{14} was prepared from sodium acetate-1-C^{14}. The kinetics of hydrolysis of the unlabeled compound in 60% dioxane–40% water were determined. The kinetic isotope effect in the hydrolysis of 2-chloro-2-methylpropane-2-C^{14} was determined by radioassay of the hydrolysis product, 2-methyl-2-propanol-2-C^{14} (in the form of its p-nitrobenzoate derivative) at various fractions of reaction. The kinetic isotope effect (k_{12}/k_{14}) was found to be 1.027 ± 0.015. This kinetic isotope effect in an Sn1 (two-center reaction) is less than the kinetic isotope effects found in a number of Sn2 (three-center reactions) involving methyl iodide-C^{14} and various nucleophiles. The differences in these kinetic isotope effects probably reflect differences

in the leaving groups as well as differences in the mechanisms of the processes. (auth)

16280

CARBON-14 KINETIC ISOTOPE EFFECTS. IV. THE EFFECT OF ACTIVATION ENERGY ON SOME CARBON-14 KINETIC ISOTOPE EFFECTS. Gabriel J. Buist and Myron L. Bender (Illinois Inst. of Tech., Chicago). J. Am. Chem. Soc. 80, 4308-11(1958) Aug. 20.

Carbon-14 kinetic isotope effects were determined in the reactions of methyl iodide-C^{14} with N,N-dimethyl-p-toluidine, N,N-diethylaniline, and N,N-dimethyl-o-toluidine in methanol solution. The activation energies of these three similar reactions are 14.5, 18.0, and 21.1 kcal/mole, respectively, and the kinetic isotope effects of these three processes are 1.117 ± 0.011, 1.120 ± 0.001, and 1.134 ± 0.047, respectively. These results are consistent with but not definitive proof that kinetic isotope effects increase with increasing activation energy. These results together with other results in the literature indicate a linear relationship between activation energy and kinetic isotope effect in a given family of reactions. The reversibility of the reaction of methyl iodide-C^{14} with N,N-dimethyl-o-toluidine and its effect on the kinetic isotope effect of the forward reaction is demonstrated. (auth)

16281

THE RADIOLYTIC SYNTHESIS OF THE cis- AND trans-ISOMERS OF 1,2-DICHLOROETHYLENE OXIDE. Jean H. Futrell and Amos S. Newton (Univ. of California, Berkeley). J. Am. Chem. Soc. 80, 4424-5(1958) Aug. 20.

The cis- and trans-forms of 1,2-dichloroethylene oxide were produced. These compounds were not reported previously, and because of current interest in radiation utilization, preliminary data on the radolytic synthesis and physical properties are presented. (J.R.D.)

16282

THE CARBON ISOTOPE EFFECT IN THE PINACOL-PINACOLONE REARRANGEMENT: A REINVESTIGATION. Vernon F. Raaen and Clair J. Collins (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 80, 4432-3(1958) Aug. 20.

The intermolecular isotope effects in the acid-catalyzed rearrangements(I) 2,3-dimethyl-2,3-butanediol-2-C^{14} and (II) 2,3-dimethyl-2,3-butanediol-2-methyl-C^{14} were reinvestigated because the magnitudes of these isotope effects were recently reported (k^*/k) as 0.74 and 0.48. It was found that in the presence of 0.295N HCl at 100°C (I) exhibits an intermolecular isotope effect no greater than 3% [$k^*/k = 0.97$] and (II) exhibits no isotope effect at all [k^*/k] = 1.00. (J.R.D.)

16283

EFFECT OF X-RADIATION ON AQUEOUS SOLUTIONS OF ADENOSINE DIPHOSPHATE. Gordon Hems and Maxwell L. Eidinoff (Sloan-Kettering Inst. for Cancer Research, New York). Radiation Research 9, 305-11 (1958) Sept.

The absorbancy at 260 mμ of a dilute solution of adenosine diphosphate decreases linearly with x ray dose up to 3×10^5 r. The principal ultraviolet-absorbing product is adenine. The concentrations of ADP and adenine in the irradiated solution were measured. Adenosine monophosphate is present only in trace amounts equal to that in control nonirradiated solutions. With combined paper chromatographic and autoradiograph techniques after the irradiation of uniformly labeled C^{14}-ADP, at least seven irradiation products were formed. Irradiation of adenosine mono- and triphosphate under similar conditions also yielded adenine as the principal ultraviolet-absorbing product. (auth)

16284

RADIATION CHEMISTRY. Milton Burton (Univ. of Notre Dame, Ind.). Record. Chem. Progr. (Kresge-Hooker Sci. Lib.) 19, 13-21(1958).

The development of radiation chemistry is reviewed. Illustrative examples cited include the following: the radiation chemistry of water, hydrocarbons, and other organic compounds; radiation-induced cross-linking of polymers; and the radiation-induced nitrogen—oxygen reaction. (C.H.)

Radiation Effects

16285

THE ACTION OF SMALL DOSES OF IONIZING RADIATION ON DEOXYRIBOSE NUCLEOPROTEINS. V. S. Tongur, N. P. Golubeva, L. S. Diskina, D. M. Spitkovskii, and G. V. Filippova (Inst. of Experimental Biology, Academy of Medical Sciences of the USSR, Moscow). Biophysics (USSR) (English Translation) 2, 461-6(1958).

The effects of radiation doses up to 100 r on the physiochemical properties of desoxyribonucleotide preparations were measured. Data are tabulated. (C.H.)

16286

DISAGGREGATION BY IONIZING RADIATION IN DEOXYRIBOSE NUCLEOPROTEIN FILAMENTS. E. V. Budilova and A. M. Kuzin (Inst. of Biophysics, Academy of Sciences of the USSR, Moscow). Biophysics (USSR) (English Translation) 4, 467-70(1958).

A method is described for preparing phosphorus-32 labeled desoxyribonucleotide preparations from rat tissues. When these preparations were exposed to 100 to 200 r of radiation some of the desoxyribonucleotide was converted to a colloidally soluble state which is readily detectable. These in vitro observations of low-dose changes in the physicochemical state of desoxyribonucleotides support the idea that structural changes may also be induced by irradiation in in vivo desoxyribonucleotides, which may be responsible for morphological and physiological effects. (C.H.)

16287

RADICAL AND MOLECULAR YIELDS IN THE γ-IRRADIATION OF LIQUID METHANOL. G. E. Adams and J. H. Baxendale (Univ. of Manchester, Eng.). J. Am. Chem. Soc. 80, 4215-19(1958) Aug. 20.

Fe(III) salts and benzoquinone are reduced during the γ-irradiation of methanol and the extent of reduction is a measure of G(radicals). These solutes also decrease $G(H_2)$, $G(CH_4)$, and G(glycol) while at the same time increasing $G(CH_2O)$. The observations are accounted for by the oxidants reacting with the radicals H, CH_2OH, and CH_3 and the results are analyzed to give G(H), $G_m(H_2)$, $G(CH_2OH)$, $G(CH_3)$, $G_m(CH_2O)$, G_m(glycol), and $G_m(CH_4)$. Appreciable differences in G(H) and $G(CH_3)$ are observed between pure methanol and methanol which is 0.1 N in sulfuric acid. (auth)

Rare Earths and Rare-earth Compounds

16288 AECU-3813

Los Alamos Scientific Lab., N. Mex.

A REVIEW OF THE RARE-EARTH HYDRIDES.

Robert N. R. Mulford. [195?]. 8p. Contract [W-7405-eng-36]. $1.80(ph OTS); $1.80(mf OTS).

Some of the properties of rare earth hydrides are reviewed. Information on the hydrides of Tm, Lu, Tb, and Ho is not included because no work has been done on these elements. Eu and Yb are different from other rare earths in that MH_2 is their highest hydride and the crystal structures of EuH_2 and YbH_2 are orthorhombic. La, Ce, Pr, and Nd form a dihydride which will take hydrogen into solid solution up to MH_3 without a change in crystal structure. The heavy rare earths form the same type of dihydride as the light, but as the hydrogen content increases from MH_2 the cubic structure becomes unstable and is replaced by a hexagonal structure. With increasing atomic number, thermal stability and hydrogen density increase. (J.R.D.)

16289

A STUDY OF THE FLAME EMISSION CHARACTERISTICS OF LANTHANUM IN AN AQUEOUS-ALCOHOLIC MEDIUM. Oscar Menis, T. C. Rains, and John A. Dean (Oak Ridge National Lab., Tenn. and Univ. of Tennessee, Knoxville). Anal. Chim. Acta 19, 179-89(1958) Aug.

The determination of lanthanum by measuring its flame emission at several wave lengths has been evaluated by means of two recording spectrophotometers equipped with special photomultiplier detecting devices. In addition, a comparison of the effect of an aqueous and alcoholic medium was carried out. In general, the interference from foreign ions is least at the higher wave length of 743 mμ. In most cases, especially with transition elements, the interference is lessened when 1:1 water–methanol solution is used. The exceptions to this rule are titanium, thorium, and zirconium which cause less interference in an aqueous solution. The method used in conjunction with a standard addition technique, has been applied to the determination of lanthanum in solutions of thorium oxide, uranium, glass, and didymium oxide mixtures. (auth)

16290

UTILIZATION OF COPPER AS A CATION EXCHANGER IN THE SEPARATION OF RARE EARTHS BY ION EXCHANGE BY MEANS OF ETHYLENEDIAMINE TETRAACETIC ACID. Jean Loriers and Claudine Lenoir. Compt. rend. 247, 468-71(1958) July 28. (In French)

The use of copper in the ion exchange of rare earths permits the following improvements. The rare earths in complex solution with EDTA acid can be fixed selectively on a resin saturated with Cu^{2+} ions. Efficient separations were obtained with EDTA acid by means of a ring of Cu^{2+} in the columns. Solutions of copper salts of EDTA acid can be used as eluants. (tr-auth)

16291

INVESTIGATION OF THE LATTICE DISORDERS OF THE FLUORITE LATTICE AND OF THE CUBIC LATTICE "C" OF THE RARE EARTH OXIDES. Maria Bruno and Aldo Mayer (Univ. of Padua). Ricerca sci. 28, 1168-73(1958) June. (In Italian)

It was found that the sesquioxides Eu_2O_3, $(Eu, Nd)_2O_3$, $(Eu, Sm)_2O_3$, and $(Eu, Gd)_2O_3$ dissolve in cerium dioxide to form anomalous mixed crystals with an edifice which is initially fluoritic and turns, with increasing sesquioxide contents, progressively into a "C" type structure. The partial cationic lattice results to be indeed completely occupied statistically by the various tetravalent and trivalent cations and the partial anionic lattice presents instead empty oxygen places with a distribution which is statistic when the sesquioxide percentage is low and becomes progressively ordered according the regularity of the cubic "C" type lattice for high sesquioxide percentages. These results agree with the admission that all the fluorite type lattices present a lattice disorder of an exclusively anionic nature, in the sense that the anions tend to abandon regular lattice positions to occupy interreticular positions and further that the "C" type lattices also show a lattice disorder of an exclusively anionic type, in the sense that the anions tend to abandon the regular lattice positions to occupy the places which the structure requires to be empty. (auth)

16292

NEW BORIDES OF THE RARE EARTH METALS. V. S. Neshpor and G. V. Samsonov. Zhur. Fiz. Khim. 32, 1328-32(1958). (In Russian)

The existence of hexaborides DyB_6, HoB_6, and LuB_6 and tetraborides DyB_4, HoB_4, and ErB_4 was established and that of the hexaborides of Gd and Er and of the tetraboride of Gd verified. On the example of lanthanum and cerium it was shown that the hexaborides are apparently the highest borides of the rare earth elements. The bond lengths of Me–Me, Me–B, and B–B were calculated. An examination of the ratio of the sum of atomic radii to these values depending upon the atomic numbers of the metals showed that in CaB_6, BaB_6, SrB_6, YbB_6, and ErB_6 the metal is in a bivalent state, whereas in the hexabromides of the other rare earth metals the latter are trivalent. (tr-auth)

Separation Procedures

Refer also to abstracts 16182, 16227, and 16240.

16293 AECU-3807

Clark Univ., Worcester, Mass.

SEPARATION OF YTTRIUM AND FISSION-PRODUCT RARE EARTHS BY ION EXCHANGE AT ROOM TEMPERATURE. E. J. Troianello and T. T. Sugihara. [1957]. 10p. Contract AT(30-1)-1930. $1.80(ph OTS); $1.80(mf OTS).

Determination of a large number of cross sections for the formation of yttrium and light rare earths in deuteron fission of uranium required a reliable chemical-separation method. In the method that has been used successfully, the separation is made using 8 to 15 mg of carriers on colloidal Dowex-50, eluting with 0.70M ammonium lactate, pH 3.30, at room temperature. Over-all chemical yields were regularly in the range of 60 to 85%, and adequate separation of adjacent rare earths was achieved. A disadvantage of the method is the relatively long time, about 35 hours, required for the elution through the neodymium band. (auth)

16294 AERE-C/M-88(Rev.)

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE FLUORIDE–HYDROXIDE, PEROXIDE AND IODATE CYCLES IN THE PURIFICATION OF PLUTONIUM. G. R. Hall and R. Hurst. 1957. Date of MS. Oct. 1950. Decl. Dec. 1956. 6p. $0.32(BIS).

The results of the purification of a batch of plutonium by a potassium plutonium fluoride–plutonium hydroxide cycle followed by a plutonium peroxide and plutonium iodate cycle are reported. Good decontamination of uranium, chromium, and iron has been obtained and the final plutonium solution has a purity of 101 ± 3%. (auth)

16295 ANL-4789

Argonne National Lab., Lemont, Ill.

ISOLATION OF GRAM QUANTITIES OF IONIUM FROM

MALLINCKRODT RAFFINATE. D. F. Peppard, G. Asanovich, R. W. Atteberry, O. DuTemple, M. V. Gergel, A. W. Gnaedinger, G. W. Mason, V. H. Meschke, E. S. Nachtman, and I. O. Winsch. Apr. 1952. Decl. Aug. 19, 1958. 59p. Contract W-31-109-eng-38. $9.30(ph OTS); $3.60(mf OTS).

A number of uranium process wastes have been examined as sources of ionium (Th^{230}). The aqueous raffinate resulting from the processing of a nitric acid leach of pitchblende concentrate by a diethylether extraction technique by the Mallinckrodt Chemical Works was chosen on the basis of potential large supply, relatively high ionium content, and relative ease of processing. A process for the isolation of ionium from this source material involving a combination of solvent extraction and precipitation techniques has been developed. This process has been tested on a pilot plant basis. Approximately sixty-six grams of ionium have been isolated. The feasibility of incorporating a uranium recovery step as well as protactinium [and polonium] isolation steps in the ionium process has been demonstrated. Several alternative processes have been investigated on a laboratory scale. (auth)

16296 BNL-471
Brookhaven National Lab., Upton, N. Y.
PILOT PLANT FLUORINATION OF URANIUM FUEL ELEMENTS BY BROMINE TRIFLUORIDE.
G. Strickland, F. L. Horn, and R. Johnson. July 26, 1957. 31p. $1.00(OTS).

Rewritten version of an internal report issued as BNL-457.

The term Fluoride Volatility Processes refers to several proposed nonaqueous methods of processing irradiated fuel elements. In each of these methods, the uranium is fluorinated to uranium hexafluoride and then decontaminated by distillation. One of the methods, involving direct fluorination of the uranium by bromine trifluoride, has been under investigation at BNL since 1950; subsequently a pilot plant was built to study this step of the process. The objectives of the program were to investigate the technical feasibility of continuous dissolution, and to determine the effect of process variables on the capacity of the equipment; namely, the effect of temperature, solution composition, flow rate, and uranium history on dissolving time as related to fuel elements of the types used at BNL, ORNL, and Hanford. The nominal capacity of the dissolver was five pounds of uranium per hour, and all process equipment was fabricated of Monel. Special equipment components and numerous safety features were utilized. The major equipment development was a canned-rotor pump used for circulation of the dissolver stream through the heat exchanger. A system for continually charging slugs to the pressurized dissolver was also developed. Operation consisted of batch runs made with unirradiated BNL slugs in order to gain information useful in the planning of continuous runs. Eight runs were made at 250°F (121°C), starting with pure bromine trifluoride and progressing to solutions containing 4 mole % uranium hexafluoride. Practical dissolution rates were obtained, and uranium hexafluoride was found to increase the dissolution rate. Its effect in reducing slug dissolution time was very marked at concentrations up to 1 mole %, became increasingly less in the 1 to 2% range, and had no effect in the 2 to 4% range. (auth)

16297 CF-57-6-125(Rev.)
Oak Ridge National Lab., Tenn.
A PRELIMINARY STUDY OF PRE-SOLVENT EXTRACTION TREATMENT OF STAINLESS STEEL–URANIUM FUELS WITH DILUTE AQUA REGIA. F. G. Kitts and J. J. Perona. Oct. 11, 1957. 23p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

The continuous dissolution of 304 stainless steel and stainless steel–UO_2 alloy in dilute aqua regia was studied with subsequent stripping of the dissolver product to remove chloride ion. The process has the advantage of producing, by means of a simple head end treatment, a solvent extract feed in a conventional nitric acid medium so that existing solvent extraction processes, materials of construction and waste disposal methods can be used. The purposes of this study were to investigate the the variables affecting the dissolution process and to obtain dissolver scale-up data, and to investigate the removal of chloride from the dissolver product and the variables affecting the stripping operation. A continuous flooded pot dissolver was used. It has the advantages of stability of operation and ease of control in comparison with column dissolvers and requires a minimum of mechanical processing prior to dissolution. Stripping of the dissolver product to remove chloride ion was studied in a 4-in. diameter Pyrex bubble-cap column containing 12 single bubble cap plates. Continuous dissolution rates and dissolver product stainless steel loadings were correlated with aqua regia feed composition, acid feed rate and surface area exposed to reaction. Profiles of chloride concentration down the stripping column were obtained for various vapor to liquid mole ratios and for several nitric acid stripping vapor concentrations. Noncondensable off-gas compositions and rates were also measured. (auth)

16298 CF-57-10-89
Oak Ridge National Lab., Tenn.
A CONTINUOUS DAREX PROCESS FLOWSHEET. F. G. Kitts. Oct. 10, 1957. 15p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

A Darex flowsheet is presented wherein dissolution of stainless steel-type fuel elements in dilute aqua regia, stripping of chloride from spent dissolver solution, adjustment of stripper product composition and rectification of HNO_3–H_2O vapors are accomplished in a completely continuous relatively simple loop process. Product from the loop needs only dilution with water to be made suitable as feed for a solvent extraction processing plant. The proposed scheme differs from earlier concepts. A continuous, pot dissolver (well-mixed liquid phase) is utilized rather than a trickle type dissolver. A strip vapor slightly lower in HNO_3 concentration than the azeotrope is used. A feed adjustment tank serves not only to recover HNO_3–H_2O vapor, but also to dehydrate any silica present and to adjust the product composition such that upon water addition the material is ready for feed to solvent extraction. In most previous concepts, separate, batchwise feed adjustment was contemplated. (auth)

16299 DP-291
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
ADSORPTION OF RUTHENIUM BY ION EXCHANGE RESINS. Charles A. Prohaska. June 1958. 16p. Contract AT(07-2)-1. $0.50(OTS).

After a preliminary treatment with thiourea, at least 90% of the ruthenium remaining in the product uranium stream from the Purex Process can be removed by ion exchange. Laboratory tests showed that this performance can be expected if the solution is treated with 0.2 gm of thiourea per 100 ml, heated either at 90°C for one-half hour or at 50°C for ten hours, and passed through an ion exchange column packed with "Amber-

lite" IRC-50 resin. The amount of thiourea is not critical; appreciable ruthenium is adsorbed in the range from 0.005 to 0.7 gm of thiourea per 100 ml of solution. A bed of "Amberlite" IRC-50 resin continues to adsorb ruthenium after one thousand bed volumes of feed solution have passed through the bed. The adsorbed ruthenium can be stripped from this resin with 6M nitric acid. The capacity of the resin remains high after stripping. (auth)

16300 ORNL-2532

Oak Ridge National Lab., Tenn.

AN ELECTROLYTIC PROCEDURE FOR THE REMOVAL OF RUTHENIUM AND NITRATE FROM ALKALINE WASTE SOLUTIONS. A. F. Messing and I. R. Higgins. Sept. 19, 1958. 36p. Contract W-7405-eng-26. $1.00(OTS).

The flowsheet proposed by KAPL for the treatment of alkaline nitrate radiochemical processing waste has been modified to include an ion-exchange step for the decontamination of cesium, strontium, and other cationic fission products. In laboratory studies of the electrolysis steps in a nitrate reduction cell, synthetic alkaline waste, 0.55 to 4.83 M total electrolyte, was decontaminated from ruthenium by factors of >210. The nitrate of 3.0 M waste was reduced to ammonia with current efficiencies of 100%. Power consumption was 4.7 kwh/lb of nitrate reduced. Significant factors affecting the rate of ruthenium decontamination were temperature, cathode area, cathode current density, and electrolyte concentration. Those affecting nitrate reduction current efficiencies were the cathode current density, electrolyte concentration, and stirring rate. In an acid-base membrane cell, reusable nitric acid as well as sodium hydroxide was regenerated. However, such a cell is less economical to construct and operate than the nitrate reduction cell. At least 5 kwh of power is required to transfer 1 lb of nitrate from ORNL type waste. In addition, the greater complexity of the acid-base cell makes it less adaptable for remote control. (auth)

16301 WIN-97

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

AMENABILITY TESTING OF ORE SAMPLES FROM THE GAS HILLS DISTRICT OF WYOMING. H. I. Viklund, E. J. Hammond, and R. U. Johnson. July 10, 1958. 22p. Contract AT(49-6)-924. $4.80(ph OTS); $2.70(mf OTS).

Data are presented to show that various ores from the Gas Hills area of Wyoming are amenable to leaching with acid or carbonate solutions. The effect of soluble organic matter in the ores is considered. (auth)

16302

SEPARATION OF NIOBIUM AND TANTALUM WITH CUPFERRON. A. K. Majumdar and J. B. Ray Chowdhury (Jadavpur Univ., Calcutta). Anal. Chim. Acta 19, 18-22 (1958) July.

An attempt to separate niobium and tantalum by cupferron was only moderately successful at pH 4.5 to 5.5 in the presence of a magnesia mixture as a coagulating agent. A more satisfactory separation of niobium and tantalum from each other, tried out up to ratios of 30:1 and 1:30, is effected with Sn^{2+} or Sn^{4+} as a co-precipitating agent. Under the conditions described niobium can be separated, in the presence of complexone III, from almost all the ions except U, Be, Ti and PO_4^{-3}. Iron and other tervalent elements, when present in 100 fold excess with respect to niobium, require double precipitation. The method gives highly satisfactory results when applied to the analysis of niobium in niobium–molybdenum stainless steel. The use of titanium as a co-precipitant is less successful than that of tin. (auth)

16303

SEPARATION OF NIOBIUM AND TANTALUM WITH N-BENZOYL-N-PHENYLHYDROXYLAMINE. A. K. Majumdar and A. K. Mukherjee (Jadavpur Univ., Calcutta). Anal. Chim. Acta 19, 23-6(1958) July.

The use of N-benzoyl-N-phenylhydroxylamine for the separation of niobium and tantalum, allows a satisfactory estimation of niobium from a tartrate solution at an acidity of 2.0N. The pH range for complete precipitation can be extended to 6.5. For tantalum precipitation, the pH of the solution should be below 1.5 and the acidity may even be above 2.0N. At pH 3.5 to 6.5, niobium is completely precipitated and tantalum remains in solution; the latter is precipitated by lowering the pH. Niobium and tantalum in ratios of 1:16 to 100:1 can be separated by a single precipitation, in the case of a ratio of 1:100 precipitation must be carried out twice. Titanium, zirconium, vanadate and molybdate interfere with the determination of niobium though other ions have no effect in the presence of complexone III and tartaric acid. The precipitates are granular and easy to filter and wash. The time taken for a complete analysis is much less than that of other methods. (auth)

16304

THE SOLVENT EXTRACTION OF TRACE ANTIMONY (V). George K. Schweitzer and L. Eldon Storms (Univ. of Tennessee, Knoxville). Anal. Chim. Acta 19, 154-61(1958) Aug.

An investigation of the extraction of trace amounts of antimony(V) from aqueous hydrochloric acid solutions into various ethers and chloroform has been carried out. Before extractions were made, mutual solubility studies of the two-phased systems were conducted. Then extraction experiments were performed using original aqueous acid concentrations from 0 to 12N and non-aqueous phases of ethyl ether, isopropyl ether, isoamyl ether, n-hexyl ether, and chloroform. Dielectric constant determinations were made in the equilibrated non-aqueous phases, and spectrophotometric and salting-out studies were carried out on the ethyl ether system. It was found that the isopropyl ether system presents the most advantageous conditions for the extraction of trace antimony(V). (auth)

16305

THE URANYL SULFATE COMPLEXES FROM TRI-n-OCTYLAMINE EXTRACTION EQUILIBRIA. Kenneth A. Allen (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 80, 4133-7(1958) Aug. 20.

The extraction of uranium from acidic sulfate aqueous systems by benzene solutions of tri-n-octylamine sulfate was measured under various conditions of uranium loading, acid activity, sulfate ion concentration, and amine concentration. An equation for the reaction between the amine sulfate–bisulfate mixture and the uranium is proposed which is consistent with the results. Under conditions of constant acid activity, amine concentration, and low uranium loading, the distributions observed at varying aqueous sulfate levels are shown to lead to estimates of the formation constants for the aqueous uranium mono- and disulfate complexes which are in reasonably good agreement with those reported by Ahrland. The present evidence suggests only very low or negligible proportions of the trisulfate complex at sulfate molarities below one. (auth)

16306

ANION-EXCHANGE STUDIES. XXIII. ACTIVITY COEFFICIENTS OF SOME ELECTROLYTES IN THE RES-

IN PHASE. Frederick Nelson and Kurt A. Kraus (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 80, 4154-61(1958) Aug. 20.

Ratios Γ of activity coefficients of a number of electrolytes in the resin ($\gamma_{\pm(r)}$) to those in the aqueous phase ($\gamma_{\pm}$) are evaluated from water and electrolyte uptake data. At high concentrations $\Gamma = \gamma_{\pm(r)}/\gamma_{\pm}$ is remarkably constant but it varies substantially at low concentrations. Activity coefficients of HCl in the resin determined as a function of HCl activity and of cross-linking can be correlated by a concentrated electrolyte model of the exchanger with the assumption that Harned's rule of the linear variation of log $\gamma_{\pm}$ with composition holds at constant total molality. Similar considerations, with Harned's rule generalized to higher multi-component systems, permits at least semi-quantitative evaluation of log $\gamma_{\pm HCl(r)}$ for HCl–LiCl mixtures where Γ_{HCl} is comparatively small. Because of the relatively low activity coefficients of HCl in the resin phase, separation of HCl from concentrated halide solutions is possible. The separations are illustrated with several HCl–LiCl mixtures. Adsorption of sulfuric acid by the sulfate form of the exchanger is discussed and evaluation of the concentration quotient of the acid constant is attempted for the bisulfate ion in the resin phase. (auth)

16307

THE DECOMPOSITION POTENTIALS OF SOME NIOBIUM COMPOUNDS AND THE SEPARATION OF NIOBIUM BY THE ELECTROLYSIS OF MELTS. Ye. I. Gurovich. Zhur. Neorg. Khim. 3, 450-5(1958). (In Russian)

The decomposition potentials of K_2NbF_7 and Nb_2O_5 were determined in molten mixtures of KF and KCl. The melt was maintained at a temperature of 850 ± 20°C. The decomposition potential for K_2NbF_7 is 1.65 v; the addition of Nb_2O_5 raised the potential to 2.56 v. A method for the production of metallic, powdery niobium by the electrolysis of molten salts is described. The melt consists of KF, KCl, K_2NbF_7, and freshly precipitated Nb_2O_5. The Nb produced has high purity with only 0.01% Nb_2O_5 at most. (J.S.R.)

16308

PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON ISOTOPE SEPARATION HELD IN AMSTERDAM, APRIL 23-27, 1957. J. Kistemaker, J. Bigeleisen, and A. O. C. Nier, eds. Amsterdam, North-Holland Publishing Company, 1958. 723p.

Papers presented at the International Symposium on Isotope Separation held in Amsterdam, 1957, and the pertinent discussions are presented. Papers in English, French, and German are included in the fields of chemical engineering, molecular interactions, chemical exchange, electromigration, distillation, thermal diffusion, diffusion, electromagnetic separation, and the development of ultracentrifuges. (C.H.)

Sorption Phenomena

16309 AERE-C/R-2632

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

KRYPTON AND XENON ADSORPTION ISOTHERMS ON CHARCOAL IRRADIATED WITH 1 MeV ELECTRONS. C. B. Amphlett and B. F. Greenfield. July 1958. 8p.

Krypton and xenon isotherms on charcoal were measured before and after irradiation with high doses of fast electrons. No reduction in uptake could be detected for doses up to 4×10^{11} rads (1350 watt-hr/g). (auth)

16310

ADSORPTION OF WATER VAPOUR ON LEAD BOROSILICATE GLASS IN VACUUM. Yutaka Tuzi and Hiroaki Okamoto (Tokyo Shibaura Electric Co., Ltd.). J. Phys. Soc. Japan 13, 960-5(1958) Aug.

The adsorption of water vapor on lead borosilicate glass was studied in the pressure region 10^{-5} to 10^{-6} mm Hg using the modified flashing technique. The adsorption is composed of at least two parts, the physical adsorption and the activated adsorption. The amount of the physical adsorption at 1×10^{-6} mm Hg, 0 to 50°C, was 0.1 to 0.4% of a monolayer, and the heat of adsorption was 11 kcal/mole. The activation energy of adsorption of the activated adsorption was about 9 kcal/mole, and the activation energy of desorption was 13 to 40 kcal/mole. (auth)

16311

THE ADSORPTION OF WATER VAPOUR BY CALCIUM FLUORIDE. C. B. Amphlett (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Trans. Faraday Soc. 54, 1206-13(1958) Aug.

The sorption of water vapor on CaF_2 was measured at 25°C after the solid had been degassed at temperatures varying from 25 to 300°C. The sorption on fresh samples is reversible, and surface areas for water sorption have been calculated using the B.E.T., Huttig, and Harkins-Jura expressions. These yield results different from those derived from C_2H_4 sorption data, while the Harkins-Jura method yields different results from the other two for water sorption. When samples are repeatedly cycled through adsorption-desorption sequences with heating at temperatures of 100° or above, the uptake is reduced and the monolayer value decreases; after a few such cycles there is no further change. This effect seems to be due to inactivation of some of the more active centers; hysteresis observed in some cases suggests that the process is partly reversible, but that ultimately destruction of the centers is complete. The mechanism may consist of inactivation due to sintering and partial reactivation by slow recrystallization in the presence of the adsorbed water film. (auth)

16312

THE HYDROGEN ABSORPTION PROPERTIES OF METALS IN RELATION TO THEIR POSITION IN THE MENDELEEV PERIODIC SYSTEM. N. N. Kavtaradze (Inst. of Physical Chemistry, Moscow). Zhur. Fiz. Khim. 32, 1214-17(1958). (In Russian)

On the basis of previously published data, it was found that the chemisorption properties of metals with respect to hydrogen are a periodic function of their position in the Mendeleev system. The possible heats of atomic adsorption of hydrogen (for $\theta_s = 1/2$) on manga- [illegible] balt, rhenium, osmium, and iridium were calcu- [illegible] suggested that the periodic function of ad- s [illegible] perties of metals exists with ethylene and oth [illegible] es, carbon monoxide, and nitrogen. (tr-auth)

Spectroscopy

16313

DETERMINATION OF RADIONUCLIDES IN LOW CONCENTRATIONS IN WATER. Bernd Kahn and S. A. Reynolds. J. Am. Water Works Assoc. 50, 613-20 (1958) May.

A number of samples of river water were analyzed for radioactivity by gamma spectrometry. Samples as large as 100 liters were taken, silt was removed by

filtration and analyzed separately, and the filtrate concentrated by evaporation. Results are tabulated from typical samples taken several miles downstream from the Oak Ridge National Laboratory. Many high-level samples of water, mud, airborne materials, and other materials were also analyzed by gamma spectrometry. (C.H.)

Syntheses

16314
METANIOBATE AND METATANTALATE OF IRON. II. A. V. Lapitskii and B. D. Nebylitsyn (Dept. of Inorganic Chemistry) Vestnik Moskov. Univ. 12, No. 2, 199-207(1957). (In Russian)

Preparation and properties of chemically pure metaniobate and metatantalate of iron are described. (R.V.J.)

Tracer Applications

16315
ISOTOPIC EXCHANGE REACTIONS BETWEEN PHOSPHORUS TRICHLORIDE AND PHOSPHORUS PENTACHLORIDE. Warren E. Becker and Rowland E. Johnson (Florida State Univ., Tallahassee). J. Am. Chem. Soc. 79, 5157-9(1957).

A measurable exchange of isotopically labeled phosphorus and chlorine has been observed between phosphorus trichloride and phosphorus pentachloride in carbon tetrachloride solution. The exchange rates are the same within experimental error and the reaction is first order in phosphorus pentachloride and zero order in phosphorus trichloride. The reactions were studied over a temperature range from 0.1 to 50.0° and the activation energy has been determined. The catalytic effect of hydrogen chloride on the chlorine exchange was investigated. (auth)

Uranium and Uranium Compounds

Refer also to abstracts 16183 and 16226.

16316
WASTES YIELD ENRICHED URANIUM. GOODYEAR ATOMIC RECOVERS VALUABLE U^{235} AND U^{238} FROM DECONTAMINATION AND LAB WASTE SOLUTIONS. B. W. Penland (Goodyear Atomic Corp., Portsmouth, Ohio). Chem. Eng. News 36, 50, 52(1958) Apr. 14.

Recovery processes are outlined by which uranium-235 and uranium-236 are recovered from decontamination and laboratory waste solutions. (C.H.)

16317
SOLID SOLUTIONS BETWEEN URANIUM MONOCARBIDE AND THORIUM MONOCARBIDE. Vittorio Cirilli and Cesare Brisi (Istituto di Chimica generale e applicata e di Metallurgia del Politecnico di Turin). Ricerca sci. 28, 1431-4(1958) July. (In Italian)

The authors investigated the solid solutions between uranium monocarbide and thorium monocarbide and they show between these two compounds a complete miscibility in the solid state. All the solids examined were prepared by vacuum reaction at 1900°C between carbon, uranium dioxide, thorium dioxide or solid solutions of the two oxides. (auth)

16318
THE SPECTROMETRIC DETERMINATION OF LOW URANIUM CONTENT IN NATURAL SAMPLES. T. M. Moroshkina, V. K. Prokof'yev, and M. N. Smirnova. Zavodskaya Lab. 23, 1324-7(1957). (In Russian)

The spectrographic determination of uranium in samples containing from 10^{-3} to 10^{-4} % U may be made by the admixture method. The uranium can then be volatilized from the melt crust. The results were compared with those obtained by chemical and luminescence methods. (J.S.R.)

16319
THE ELECTROCHEMICAL OXIDATION OF QUADRIVALENT URANIUM SALTS ON A PLATINUM ELECTRODE. K. I. Rosental' and V. I. Veselovskii (Karpov Inst. of Physical Chemistry, Moscow). Zhur. Fiz. Khim. 32, 1341-7(1958). (In Russian)

Results are presented from a kinetic study of the electrochemical oxidation of UO^{2+} ions on a rotating Pt microelectrode, made with the aid of the anodic polarography method. A wave for the anodic oxidation of UO^{2+} ions with $E_{1/2}$ = 1.05 v and directly proportional to the UO^{2+} ion concentration over the range 1.10^{-2} to 2.10^{-4} M was found on the I–E curves obtained in 1N $HClO_4$. This makes the method useful for analytical purposes. The effect was shown of the rate of application of potential on the polarographic characteristics of the process, connected with change in state of the surface of the Pt electrode with time. A possible reaction mechanism was proposed according to which the rate determining stage is the interaction of the UO^{2+} ions with oxygen electrochemically adsorbed on Pt at potentials at which reaction occurs. (tr-auth)

Waste Disposal

16320 UCRL-8380
California. Univ., Berkeley. Radiation Lab.
THE DISPOSAL OF RADIOACTIVE WASTE MATERIALS AT THE UNIVERSITY OF CALIFORNIA RADIATION LABORATORY. John A. Kaufmann and Nelson B. Garden. June 1958. 13p. Contract W-7405-eng-48. $0.50(OTS).

The philosophy of "concentrate and confine" as applied to work with radioactive materials at UCRL has made possible special packaging and disposal procedures for radioactive wastes. These procedures and their advantages and disadvantages are discussed, and approximate costs are given for the various types of packages produced. (auth)

16321
THE SOIL ECOSYSTEM AND RADIOACTIVE WASTE DISPOSAL TO THE GROUND. Stanley I. Auerbach (Oak Ridge National Lab., Tenn.). Ecology 39, 522-9(1958) July.

A review of the knowledge of the soil ecosystem is presented including some aspects of current research pertaining to soil disposal of fission products. Some of the results of research started at ORNL on limited aspects of the problem are included. (J.R.D.)

ENGINEERING

16322 AECU-3799
Du Pont de Nemours (E. I.) & Co. Savannah River [Lab.], Augusta, Ga.
SELECTION AND APPLICATION OF PROTECTIVE COATINGS AT THE SAVANNAH RIVER PLANT. G. Mackey. Mar. 1, 1955. 98p. Contract [AT(07-2)-1]. $15.30(ph OTS); $5.40(mf OTS).

A report is presented to summarize experience gained in the application of protective coatings, not including conventional oil paints, during construction of the Savannah River Plant so that future similar sites may benefit. Reasons are given for protective coatings, the selection of the coatings, the techniques required for satisfactory preparation of surfaces, and the methods of applying coatings to masonry, metal, and wood surfaces. The organization requirements, personnel training, technical assistance necessary to do this work on a large scale, and the problems encountered and steps required to solve them are included. (auth)

16323 PRL-5.23

Pennsylvania State Univ., University Park. Petroleum Refining Lab.

FLUIDS, LUBRICANTS, FUELS AND RELATED MATERIALS. Quarterly Report for January, February, and March 1958. Mar. 31, 1958. 85p. Contract AF33 (616)-5460.

The high-temperature properties of five paraffinic resins and a synthetic condensation type resin are discussed. The superior over-all stability properties of two Pennsylvania paraffinic resins at 700°F are demonstrated. Batch hydrogenation of a Pennsylvania paraffinic resin is described. The increasing difficulty of hydrogenation is related to increasing molecular weight for conventionally refined fractions from the same crude source. The reduction of dispersant properties of bright stocks and resins by hydrogenation is noted. The thermal stabilities of an ester and a polyester of the neopentyl type are compared with other neopentyl esters evaluated previously. A similarity in high temperature oxidative behavior is shown between monisopropyl biphenyl and a partially hydrogenated condensed ring aromatic hydrocarbon fraction. Low molecular weight Acryloid polymers of the dispersant and conventional viscosity-index (V. I.) improver type are compared with commercially available additives of each type. Additional laboratory data are given for a series (MLO 7291 through MLO 7298) of experimental mineral oil jet engine lubricants. These data include lubricity tests, evaporation at 400°F, isothermal successive oxidation tests at 500°F, and non-isothermal successive oxidation tests at 500 and 347°F. The successive oxidation tests adequately illustrate dirtiness of the type noted in the J-57 jet engine tests. The mineral oil formulations MLO 7291 through MLO 7298 show less dirtiness and more oxidative stability in the successive oxidation tests than do the MIL-L-7808 type lubricants. Within the mineral oil series advantages are shown for the higher molecular weight bright stock and the dispersant type additive package in terms of cleanliness in the successive oxidation tests. A trend toward increasing dirtiness in some naphthenic mineral oils and decreasing dirtiness in some paraffinic mineral oils has been shown for silicone antiform additives under 347°F oxidation conditions. The selectivity of dithiocarbamate oxidation inhibitors for paraffinic mineral oils is demonstrated. Batch to batch variation in the effectiveness of a dithiocarbamate additive is also discussed. The use of a dispersant additive to improve the high temperature (500°F) oxidative dirtiness of isosebacate ester formulations is illustrated. A technique for the quantitative determination of oxygen assimilated in the controlled atmosphere panel coker has been developed. Preliminary tests show no correlation between the quantity of oxygen absorbed and the panel deposit value. A severe oxidation effect has been found for the Spec. MIL-L-7808 type evaporation test at 400 and 500°F. Oxidation inhibitors in esters have been shown to be a significant factor in controlling evaporation loss in the 400°F test. The evaluation of a series of experimental phosphorous-type lubricity additives in the four-ball wear tester is discussed. The use of fuel dilution in mineral oils to achieve improved low temperature fluidity is illustrated. Increased test severity in the single-pass high temperature lube rig is demonstrated for tests in which air rate is increased or flow rate is decreased. (auth)

16324

THE 300-TON GOLIATH CRANE AT HUNTERSTON. D. J. Ingram and R. A. Geary. G. E. C. Atomic Energy Review 1, 217-22(1958) Sept.

Following an outline of the reasons which led to the adoption of a Goliath crane for use in constructing the nuclear reactors at Hunterston, a description is given of the structure and electrical equipment of the crane. The method of erecting this 200-ft wide by 200-ft high structure is briefly described, with photographic illustrations, and some examples of the crane's use are given. (auth)

16325

A METAL THROUGH GLASS SEAL. E. J. Davis (Imperial Coll. of Science and Tech., London). J. Sci. Instr. 35, 308(1958) Aug.

A reliable seal with small current-carrying capacity is discussed. The seal is based on the Houskeeper technique which relies on the elasticity of both glass and metal used, to compensate for their widely different coefficients of expansion. (A.C.)

16326

A NULL-POINT PRESSURE INDICATOR FOR USE AT HIGH TEMPERATURE. P. E. Liley (Imperial Coll. of Science and Tech., London). J. Sci. Instr. 35, 308-9 (1958) Aug.

A device which enables gas pressures up to 125 atm. at temperatures up to 675°C to be transmitted with high precision is described. (A.C.)

16327

HIGH-PRESSURE TECHNIQUES. D. M. Warschauer (Massachusetts Inst. of Tech., Lexington) and William Paul (Harvard Univ., Cambridge, Mass.). Rev. Sci. Instr. 29, 675-9(1958) Aug.

This paper supplies information on hydrostatic pressure techniques up to 20,000 kg/cm^2 under two headings. Under general pressure techniques, low temperature seals, experience with small diameter tubing, a pressure measuring bridge, and various tubing seals are described. Under optical techniques, optical windows of sapphire, germanium, and silicon, suitable pressure fluids, and a mechanism for moving samples inside a pressure vessel for use to 10,000 kg/cm^2 are discussed. (auth)

Heat Transfer and Fluid Flow

Refer also to abstracts 16688 and 16751.

16328 NACA-TN-4354

Langley Aeronautical Lab., Langley Field, Va.

MEASUREMENTS IN A SHOCK TUBE OF HEAT-TRANSFER RATES AT THE STAGNATION POINT OF A 1.0-INCH-DIAMETER SPHERE FOR REAL-GAS TEMPERATURES UP TO 7900° R. Alexander P. Sabol. Aug. 1958. 15p.

The heat-transfer rates were determined at Mach numbers between 6.4 and 13.9 from measurements of the surface-temperature change with time of a thin-film-platinum resistance surface thermometer. The test results are presented and compared with the

predictions of two theories, and the compatibility of these results with other experimental results obtained with both a thin-film surface thermometer and a calorimeter-type gage is pointed out. Data from tests in which a thin-film thermocouple was used are also included for comparison. (auth)

16329 AERE-Lib/Trans-786
HEAT TRANSFER AND PRESSURE DROP IN ROUGH TUBES. Wolfgang Nunner. Translated by F. Hudswell (U.K.A.E.A., Atomic Energy Research Establishment) from VDI–Forschungsh. Beil. Forsch. Gebiete Ingenieurw. 22B, No. 455, 5-39(1956). 68p.

Heat transfer and pressure drop measurements in one smooth, eight artificially roughened, and three naturally rough tubes, in which air flowed in the range of Reynolds numbers from 500 to 80,000 with and without hydrodynamic entry regions, were performed. The known results for the smooth tube were adequately confirmed. The heat transfer in the rough tubes with turbulent flow proved to be always better than for the smooth tube and had about three times the value obtained in the smooth tube when using the greatest roughness. The measured resistance numbers yielded the known trends in type and magnitude; their maximum values were ten to fifteen times as large as those obtained in the smooth tube. Although the various roughness characteristics differed considerably from one another it was found possible to represent the Nusselt number in the turbulent region, independently of the type of roughness, as a function only of the Reynolds number and the resistance number and, within a limited range of resistance numbers, to state a simple power law governing it. It is deduced from the theoretical equation that the heat transfer in rough tubes is only a little better than in smooth tubes when the Prandtl numbers are large, but considerably better when the Prandtl numbers are small. For equal energy expenditure in pumping a heat exchanger with a rough surface needs a smaller area than a smooth exchanger at low Prandtl numbers and, therefore, artificial roughnesses can provide considerable advantages in certain circumstances in the construction of heat exchangers. (auth)

16330
BEST METHODS FOR PRANDTL NUMBER. Wallace R. Gambill (Union Carbide Chemicals Co., Charleston, W. Va.). Chem. Eng. 65, No. 17, 121-4(1958) Aug. 25.

The Prandtl number, usually defined as $N_{Pr} = C\rho\mu/k$, assembles into one group the properties heat capacity, viscosity, and thermal conductivity of a fluid. The methods for estimating N_{Pr} for gases, gas mixtures, and liquids are presented, along with a discussion of ways to estimate the Schmidt number, N_{Sc}, for use in convective mass transfer calculations. (J.R.D.)

16331
ON SOME PRECISE SOLUTIONS OF GAS DYNAMICS EQUATIONS. S. S. Grigoryan (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 121, 606-9 (1958) Aug. 1. (In Russian)

Some precise solutions are given for non-stationary gas dynamics for the problem of an ideal, non-conducting gas in which the shock wave has an area in the back where the speed of sound is different from zero but in which the initiated second shock never catches up with the first one. (R.V.J.)

16332
THE DEVELOPMENT OF FINNED TUBES FOR STEAM-RAISING UNITS. A. Lymer. G. E. C. Atomic Energy Review 1, 188-94(1958) Sept.

Two methods are described in which heat-transfer data obtained with atmospheric air flowing across a bank of finned tubes may be transposed for use with hot pressurized carbon dioxide as encountered in steam-raising units. A method to measure the local heat-transfer coefficient over the surface of an annular fin is given, and the use of a water model to give the flow pattern and velocity distribution in a bank of plain or finned tubes is described. The use of a simple wind-tunnel balance to determine the change in pressure-drop coefficient through a bank of plain or finned tubes enables an extrapolation of the pressure drop for any number of rows to be made. (auth)

16333
LAMINAR TUBE FLOW WITH ARBITRARY INTERNAL HEAT SOURCES AND WALL HEAT TRANSFER. E. M. Sparrow and R. Siegel (Lewis Flight Propulsion Lab., Cleveland). Nuclear Sci. and Eng. 4, 239-54(1958) Aug.

An analysis is made to determine the heat transfer characteristics for laminar flow of a heat generating fluid in a circular tube with wall heat transfer. The internal heat generation is permitted to vary in an arbitrary manner both longitudinally along the tube and radially across the section. In addition, arbitrary longitudinal variations in the wall heat transfer may be present. The results obtained apply along the entire length of the tube, that is, in the thermal entrance region as well as far down the tube. Numerical results are evaluated for certain special cases such as uniform and parabolic radial heat source distributions. (auth)

16334
THE VACUUM FLOWMETER. M. I. Basalaev and N. Ya. Basalaeva. Pribory i Tekh, Ekspt. No. 2, 75-8(1958) Mar.-Apr. (In Russian)

The design is given of an apparatus for measuring gas flow in vacuum. The scheme is based on measurements of pressure drop on a diaphragm. The drop in pressure is measured by the current magnitude across a bridge scheme, in which two identical resistance manometers placed on both sides of the diaphragm act as the arms. (tr-auth)

16335
THE IDEA OF THE MEAN IN THE THEORY OF TURBULENCE. Kampé De Fériet. Rend. seminar. mat. fis. Milano 27, 167-207(1957). (In French)

Definitions and conditions for average values are indicated, in order to transform Navier equations of viscous flow into Reynolds turbulence equations. A discussion shows that classical average values definitions are inadequate. The right definition is investigated with the help of topological rings theory. Finally statistic mean definition is discussed. (auth)

Materials Testing

16336 AID/Met/28
Gt. Brit. Ministry of Supply. AID Labs., Harefield, Middx, England.
AN EXTENSOMETER WITH CAMERA ATTACHMENT FOR HIGH SENSITIVITY CREEP TESTS. A. E. Walmsley and F. J. Tranter. July 1956. 16p.

A method of recording creep extensometer readings using an automatic camera with a slightly modified Marten's type extensometer is described. (auth)

16337 ANL-5614
Argonne National Lab., Lemont, Ill.
A PULSED EDDY CURRENT TECHNIQUE FOR MEASURING CLAD THICKNESS. Metallurgy Program 12.1.2. D. L. Waidelich, J. A. DeShong, and W. J.

McGonnagle. May 1955. 50p. Contract W-31-109-eng-38. $1.50(OTS).

A pulsed eddy current technique for measuring the cladding thicknesses of reactor fuel elements is described. Special emphasis has been put on the measurement of zirconium cladding. In this technique an electromagnetic field is applied at the surface of the clad fuel element by means of a probe coil. Whenever the waves encounter a sudden discontinuity, such as an interface, "echoes" are produced. The same probe coil is used for sending the electromagnetic radiation and receiving the echoes. The echo received from the front surface of the specimen is balanced out by means of a bridge circuit. The echo from the clad core interface contains information concerning the thickness of the clad. The echo has a positive peak followed by a small negative peak. The "crossing point" between the positive and negative peak or the amplitude of the echo can be used to determine clad thickness. One of the difficult problems with this technique is the extreme sensitivity to variations in probe-to-metal spacing. Methods for eliminating or minimizing this effect have been tried, with some success. (auth)

16338 NYO-2323

Southwest Research Inst., San Antonio.

RESEARCH ON PROPERTIES OF MATERIALS EMPLOYED IN PRESSURE EQUIPMENT. Progress Report No. 2. L. U. Rastrelli and M. M. Lemcoe. Aug. 8, 1958. 52p. Project No. 774-2. Contract AT(20-1)-2146. $9.30(ph OTS); $3.60(mf OTS).

A literature review concerning pressure vessels and a list of recommended pressure vessel materials research programs providing information in those areas where material data are lacking are presented. In addition, an over-all literature survey emphasizing cumulative damage theories and the phenomenological behavior of pressure vessel materials under dynamic load, elevated temperatures, and environments other than air is given. 80 references. (J.R.D.)

16339

APPARATUS FOR MECHANICAL STUDIES OF METALS UNDER 30000 kg/cm PRESSURE. Yu. N. Ryabinin, L. F. Vereshchagin, D. B. Balashov, and L. D. Livshits (Lab. of Superhigh Pressures, Academy of Sciences, USSR). Pribory i Tekh. Eksp. No. 2, 79-85(1958) Mar.-Apr. (In Russian)

A design is presented for a high-pressure hydrostatic installation with pressure capacity up to 30,000 kg/cm^2 in an enclosed space of $\phi \sim 13$ mm and 40 to 70 mm long. The performance of a thick-walled container resting on a conical-shaped prop was studied. Descriptions are given of a seven-channel electric conduit, a manganin resistance manometer, and an installation for testing metallic specimens for ductility under high hydrostatic pressure. (tr-auth)

16340

SOME MECHANICAL PROPERTIES OF MYLAR AND DACRON POLYESTER STRANDS AT LOW TEMPERATURES. R. P. Reed and R. P. Mikesell (National Bureau of Standards, Boulder, Colo.). Rev. Sci. Instr. 29, 734-6(1958) Aug.

Dacron polyester fiber and Mylar polyester sheet were tested in tension and impact at four temperatures: 296°K, 228°K, 195°K, and 76°K. Dacron strand increased in ultimate strength as the temperature decreased, while Mylar ultimate strength dropped. Both fibers showed less elongation at lower temperatures. Mylar at low temperatures was not capable of absorbing as much energy as at room temperature. (A.C.)

16341

DEVICE FOR TESTING METALS AT HIGH TEMPERATURES. A. G. Bobrov. Leningrad, Leningradskiy dom nauchno-technicicheskoy propagandy, and Vsesoyuznoye obshchestvo po rasprostraneniyu politicheskikh i nauchnykh znaniy, 1955. 4p.

The design and construction of an apparatus for high-temperature testing of the strength and plasticity of metals samples are given. The apparatus consists of an electric furnace with suitable temperature control (1200° to 1250°C), an extensometer, and a loading device. (J.S.R.)

16342

NONDESTRUCTIVE TESTING AND INSPECTION. Vasility Stepanovich Sokolov. Moscow, Gosenergoizdat, 1957. 239p.

This book, intended for engineers and technical personnel, is a practical manual on nondestructive testing and inspection of materials. An attempt is made to compile the most highly developed and widely employed methods in industry for detecting flaws in materials and finished products. The first part of the book deals with magnetic inspection, the second with fluorescent-penetrant and dye-penetrant inspection, the third with ultrasonic inspection, and the fourth with radiographic inspection. (J.S.R.)

16343

SYMPOSIUM ON NONDESTRUCTIVE TESTS IN THE FIELD OF NUCLEAR ENERGY. Presented in Chicago, Ill., April 16-18, 1957. ASTM Special Technical Publication No. 223. Philadelphia, American Society for Testing Materials, 1958. 402p. $10.00.

The papers presented at the symposium on nondestructive tests in the field of nuclear energy, held in Chicago, Ill., April 16 to 18, 1957, are presented in this volume. The volume consists of four parts: survey and educational lectures, testing of reactor components, testing of fuel assemblies, and miscellaneous. (W.L.H.)

16344

SYMPOSIUM ON RADIATION EFFECTS ON MATERIALS. VOLUME 2. Presented at the Sixtieth Annual Meeting, Atlantic City, N. J., June 20, 1957. ASTM Special Technical Publication No. 220. Philadelphia, American Society for Testing Materials, 1958. 141p. $3.75.

Papers and discussions are included on the following topics: the selection of structural materials for components of nuclear power plants; problems associated with controlled irradiation studies of nuclear fuels; radiation effects studies at the Battelle Research Reactor; a technique for measurement of electrical resistivity of radioactive metals; techniques of tension testing irradiated materials at elevated temperatures; techniques for making visual examinations and dimensional measurements of highly radioactive fuel elements, structural materials, and other test specimens; remote metallographic equipment; the effect of heat treatment and burnup on radiation stability of 10 wt. % molybdenum–uranium fuel alloys; effects of radiation on nuclear fuels; the radiation stability of hydrocarbon fuels; the selection of organic materials as reactor coolant-moderators; and the effects of radiation on semiconductor devices and other electronic components. (C.H.)

Vacuum Systems

16345

SLIDING AND ROTATING MECHANICAL AND ELECTRICAL FEED-THROUGH SEALS INTO A VACUUM.

N. Fuschillo (Pennsylvania State Univ., University Park and Franklin Inst., Philadelphia). Am. J. Phys. 26, 400(1958) Sept.

Low-cost rubber seals for use in vacuum systems at pressures down to 10^{-6} mm Hg are described. The seals permit almost unlimited rotational and longitudinal freedom as well as provide a reliable and easily demountable feed-through system for electrical connections. (D.E.B.)

16346

MEANS FOR ATTAINING VACUA WITHOUT THE USE OF PUMP FLUIDS. I. Ames, R. L. Christensen, and J. Teale (IBM, Poughkeepsie, N. Y.). Rev. Sci. Instr. 29, 736-7(1958) Aug.

A technique for producing vacua with minimum contamination in moderate-sized systems has been developed. The essential feature is that no pump fluids are required. The method involves reducing the pressure from atmospheric to about 1 μ by use of a "finger" cooled by liquid helium and the subsequent continuance, if necessary, to the high or ultra-high vacuum range by ion-getter pumping. (A.C.)

16347

DEMOUNTABLE VACUUM SEAL FOR ATTACHING AN END-PLATE TO A GLASS TUBE. Horace R. Moore (California Inst. of Tech., Pasadena). Rev. Sci. Instr. 29, 737-8(1958) Aug.

A demountable vacuum seal for attaching an end-plate to a glass tube is described. A type of O-ring is used. Rotation of a knurled lock-ring caused the 45° level on the collar to press against the O-ring, the collar sliding freely on the tube. Equal pressures are then transmitted by the O-ring onto the surfaces to be sealed—the outer tube surface and the inner surface of the end-plate. (A.C.)

Waste Disposal

16348 AECD-4269

Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.

DESIGN AND ECONOMIC STUDY OF HOT OFF-GAS STORAGE SYSTEM. C. S. Johnson and T. J. Carter. Dec. 20, 1957. Decl. with deletions June 27, 1958. 24p. For [Oak Ridge Gaseous Diffusion Plant. Contract W-7405-eng-26, Subcontract 70]. (KT-327(Del.)). $4.80 (ph OTS); $2.70(mf OTS).

A study was made of the various gas disposal methods that might be used to handle the radioactive fission product gases, krypton, xenon, and iodine. The practicality of atmospheric disposal is dependent on the ability to control radioactive gas release so that only concentrations below the tolerance level are encountered by humans. When meteorological conditions are favorable, the high activity dissolver off-gas can be discharged from tall stacks. However, when meteorological conditions are unfavorable, discharge to the atmosphere is not possible and temporary storage facilities must be provided. These storage facilities, in addition to preventing discharge of radioactive gases to the atmosphere, act as a "holdup" tank so that the shorter-lived activities can decay away before discharge to the atmosphere. However, since a considerable portion of the activity is the contribution of 10.27 year half-life krypton-85, reduction of activity levels by this means is relatively insignificant. Storage of the radioactive gases for safe release to the atmosphere can be accomplished by means of ambient temperature charcoal adsorbers, low temperature charcoal absorbers, high pressure tanks, or low pressure gas holders. With the present information available, it was not felt an intelligent design using charcoal adsorbers could be made. Also, because of the relatively large gas volume and the risk (from accidental release of the gas) involved in high pressure storage, this technique was not considered practical. Accordingly, it was felt that a slightly subatmospheric storage system offered the most promise at the present time for providing safe and economic temporary storage of the radioactive gases. Therefore, the technical feasibility of such a system has been studied and a preliminary design and cost analysis are submitted. (auth)

16349 AERE-E/R-2625

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

EXERCISE MERMAID. P. Bowles, R. H. Burns, F. Hudswell, and R. T. P. Whipple. Aug. 1958. 230p. $6.30(BIS).

The exercise was performed because of the proposal to erect an Atomic Energy Research Establishment at Winfrith Heath, Dorset, England. This proposal would involve continued discharge of radioactive liquid effluent to the sea. Trials were initiated to measure the dispersal rate of soluble effluent, simulated by fluorescent dye, from various points south of Arish Mell. The objects were to determine the optimum position for outlet of discharge pipe and to obtain fundamental data for estimating the contamination likely to arise. (W.D.M.)

16350 AEC-tr-3296

IS IT PERMISSIBLE THAT ATOMIC INDUSTRY WASTE BE DUMPED INTO THE BLACK SEA? V. A. Vodianitskii (Vodianitsky). Translated by the Oak Ridge National Lab. Library Staff from Priroda 2, 46-52(1958). 16p.

Arguments are offered for the assumption that vertical displacement is negligibly small in the Black Sea, making it possible to dispose of radioactive waste at the bottom. (T.R.H.)

MINERALOGY, METALLURGY, AND CERAMICS

16351 AD-133968

Sciaky Bros., Inc. Research Div., Los Angeles.

HEAT RESISTANT MATERIALS RESISTANCE WELDING SURVEY. Summary Report. Apr. 24, 1957. 72p. Project No. 6-0-136. Contract AF33(600)34372.

The results of a limited survey of airframe and engine manufacturers on resistance, spot, seam, and flash welding are presented. The survey was aimed specifically at heat and corrosion resisting alloys. Nine companies were interviewed, and their answers are summarized. (W.L.H.)

Ceramics and Refractories

16352

EVALUATION OF THE THERMAL INSULATIVE CHARACTERISTICS OF CERAMIC COATINGS. W. J. Plankenhorn (Chicago Vitereous Corp., Cicero, Ill.). Am. Ceram. Soc. Bull. 37, 366-9(1958) Aug.

A differential thermocouple technique for evaluating the insulative characteristics of ceramic coatings is described. Data obtained by this method show that se-

lected coatings which were essentially vitreous caused heat to penetrate the metal more rapidly than when there was no coating present. A coating containing a large percentage of refractory materials and a minimum of glass had the reverse effect. (auth)

16353

THE INTERNAL FRICTION OF BARIUM TITANATE CERAMICS. Takuro Ikeda (Kobayasi Inst. of Physical Research, Tokyo). J. Phys. Soc. Japan 13, 809-18 (1958) Aug.

The internal friction of $BaTiO_3$ ceramics has been studied under various conditions. It depends on temperature, biasing field, and vibration amplitude, but is nearly independent of frequency and porosity. It is concluded that its main part is not caused by the ceramic and domain structures but is the property of the single domain crystal, which is of intrinsically dielectric origin, acting through piezoelectric coupling. (auth)

16354

A STUDY OF THE PROPERTIES OF MOLTEN TITANATES BY THE EMF METHOD. V. I. Musikhin and O. A. Esin (Inst. of Metallurgy, Lverdlovsk). Zhur. Fiz. Khim. 32, 1372-8(1958). (In Russian)

The electromotive force was measured for concentration cells without transport in Na_2O-TiO_2 and $MnO-TiO_2$ melts at 1200 and 1470°C. From the data obtained the activities of the components were calculated. The character of the electromotive force isotherms indicates a large negative deviation of these solutions from the ideal. Breaks in the curves were revealed corresponding to the congruent melting compounds $Na_2O \cdot TiO_2$, $Na_2O \cdot 2TiO_2$, and $2MnO \cdot TiO_2$, bearing evidence of the ordering of the melts. As exemplified by the system Fe–Si, a comparison was made with the experimental data of the quasi-chemical formula. It was suggested that on melting the coordination number of FeSi decreases. (tr-auth)

Corrosion

16355 BMI-1284

Battelle Memorial Inst., Columbus, Ohio.

CORROSION AND CREEP BEHAVIOR OF TANTALUM IN FLOWING SODIUM. Gilbert E. Raines, C. Vernon Weaver, and John H. Stang. Aug. 21, 1958. 29p. Contract W-7405-eng-92. $1.00(OTS).

The corrosion behavior of commercial tantalum in high-purity flowing sodium from 700 to 1200°F and the effect of sodium exposure on the creep strength of tantalum at 1200°F were investigated. The tests were conducted in forced-convection flow loops constructed of Type 316 stainless steel. With continuously gettered sodium systems (probably containing less than 10 ppm oxygen) operating for periods up to 50 days, weight losses sustained by 1200°F specimens corresponded to only about 0.1 mil of metal removed per year. Maximum weight losses, encountered with a continuously cold-trapped (about 40 ppm oxygen) sodium system, were equivalent to about 3 mils per year for 1200°F specimens. For the most part, metallographic examinations revealed no deleterious corrosion effects; however, one particular group of arc-cast tubing specimens suffered severe intergranular attack in sodium with about 80 ppm oxygen. In addition to the corrosion findings, the corrosion tests yielded information about the partition of interstitials, particularly oxygen, in the sodium–tantalum system. Oxygen, for example, showed a tendency for migration from tantalum to high-purity sodium considerably stronger than would be predicted from limited thermodynamic data available. In the creep experiments, the oxygen content of the sodium was maintained at the <10 ppm level by continuous gettering. In general, the results demonstrated that sodium exposure at 1200°F had very little, if any, effect on tantalum creep strength. Baseline data necessary to establish this were obtained in supplementary helium-atmosphere creep tests. (auth)

16356 DP-284

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

CORROSION BY SOLUTIONS CONTAINING HNO_3, HF, AND REDUCING AGENTS. M. LaVern Holzworth. May 1958. 24p. Contract AT(07-2)-1. $0.75(OTS).

The corrosion of stainless steel in mixtures of nitric and hydrofluoric acids is markedly increased by the addition of either hydroxylamine nitrate or sulfamic acid, but not by the addition of ascorbic acid. Silver, Hastelloy C, and Monel corroded at rates less than five mils per year in a nitric acid–hydrofluoric acid solution containing hydroxylamine nitrate, sulfamic acid, and ascorbic acid. Hastelloy B, Haynes 25, Carpenter 20, and Nionel corroded at rates up to 26 mils per year. Corrosion rates of about 25 mils per year were considered acceptable for this application. The corrosion of Type 304L or Type 309Cb stainless steel in a solution of nitric and hydrofluoric acids containing a reducing agent was decreased to less than 20 mils per year by the addition of either aluminum or silver ions. Very small concentrations of either cupric or ferric ions lowered the corrosion rate of 309Cb stainless to less than five mils per year in the same solution. (auth)

16357 HW-55245

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

OPERATIONAL EXPERIENCE WITH A HIGH TEMPERATURE ORGANIC LOOP. J. L. Poe. Mar. 6, 1958. 11p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

Facilities were established for evaluating high-temperature organic coolants for both in-reactor and out-of-reactor testing. The organic recirculation apparatus for an out-of-reactor high-temperature loop was designed to determine the corrosive effects of organic compounds on reactor components and fuel cladding materials. A description of the equipment and operation of the loop are presented. (J.E.D.)

16358 HW-55854

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

CORROSION EFFECTS OF A TURCO 4306-B SIMULATED FLUSH ON A 1706-KE MOCK-UP TUBE. T. V. Lane. Apr. 28, 1958. 4p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

An out-of-reactor test in a mock-up tube with 25 Al clad dummies and with a Turco 4306-B flush is described. At 120° the flush causes no excessive corrosion (0.04 mil), but the corrosion rate was accelerated for 15 days following the flush resulting in a net overall penetration of 0.1 mil. No unusual pitting of tube or dummies was revealed by microscopic examination. Trapping of Turco in stagnant crevices does not seem to be a problem. (T.R.H.)

16359 USBM-U-43

Bureau of Mines. [Northwest Electrodevelopment Experiment Station,] Albany, Oreg.

THE RELATIVE CORROSION RESISTANCE OF ZIRCALOY 2 MADE FROM ELECTROLYTIC ZIRCONIUM POWDER AND THAT OF THE CORRESPOND-

ING ALLOY MADE FROM KROLL PROCESS SPONGE. M. D. Carver and E. T. Hayes. July 22, 1955. Changed from OFFICIAL USE ONLY Aug. 28, 1958. 8p. $1.80 (ph OTS); $1.80(mf OTS).

To determine the corrosion resistance of specimens of Zircaloy-2 made from electrolytic zirconium powder relative to that for the corresponding alloy made from Kroll Process sponge, corrosion specimens made from each of five lots of powder were tested both in high-temperature water and in steam. Corrosion data were compared to those for specimens from production lots, made from sponge, tested concurrently. Samples of the sheet from each of the lots of powder were subjected to chemical analysis and the results were compared to the specification limits of the specification governing the production of Zircaloy-2. The amounts of the impurities aluminum, nitrogen, and titanium, elements known to adversely affect corrosion resistance of Zircaloy-2, were found to be high. Corrosion resistance of Zircaloy-2 made from the powder was found to be much lower than that of the corresponding alloy made from sponge. (auth)

16360 USBM-U-53

Bureau of Mines. [Northwest Electrodevelopment Experiment Station], Albany, Oreg.

HOT WATER CORROSION RESISTANCE OF HANFORD ZIRCONIUM AND ZIRCALOY 2 TUBING. M. D. Carver and E. T. Hayes. Oct. 5, 1955. Changed from OFFICIAL USE ONLY Aug. 28, 1958. 14p. $3.30(ph OTS); $2.40(mf OTS).

Samples of two types of Hanford reactor tubing, zirconium and Zircaloy-2, in each of four conditions, as rolled, stress relieved in air at 800°F, stress relieved in argon at 800°F, and vacuum annealed at 1400°F, were subjected to hot water corrosion tests to determine the relative effect on the corrosion resistance of each of the three heat treatments following fabrication. Also, it was undertaken to determine what effect an etching treatment following fabrication would have on the corrosion resistance. It was found that for both types of tubing a longer life in hot water was obtained from vacuum annealing at 1400°F than from any of the other conditions in which the specimens were tested. Of the other three conditions, none was shown to be definitely superior to the other two. The results show that, for both types of tubing, etching can be expected to improve the corrosion resistance of the as-rolled tubing and of the as-rolled tubing which has been subjected to a stress relief in argon. The results show also that, for both types, etching can be expected to lower the corrosion resistance of the as-rolled tubing which has been subjected to a stress relief in air. Furthermore, the results show that, for the as-rolled tubing which was subjected to vacuum annealing at 1400°F, etching either did not affect or affected only slightly the corrosion resistance of Zircaloy 2 tubing, but improved the corrosion resistance of the zirconium tubing. (auth)

16361 USBM-U-60

Bureau of Mines. Northwest Electrodevelopment Experiment Station, Albany, Oreg.

THE HOT WATER CORROSION RESISTANCE OF THE Hf–Ti ALLOYS. M. D. Carver and E. T. Hayes. Nov. 10, 1955. Changed from OFFICIAL USE ONLY Aug. 28, 1958. 10p. $1.80(ph OTS); $1.80(mf OTS).

The purpose of the investigation was to determine the corrosion resistance, relative to that of Zircaloy-2 and relative to that of others in the series, of each alloy of the Hf-Ti series comprising, in 10% steps, those in the range 10 to 90% titanium. Each alloy was made in the form of a 100 gram button which was rolled to sheet and then annealed at 900°C for 48 hr and cut into corrosion specimens which were tested both in water at 680°F and in steam at 750°F, both tests being conducted according to standard practice established by the Zirconium Corrosion Committee for testing alloys of zirconium. The results indicated that relative to Zircaloy-2 the alloys of the Hf–Ti series of 10 to 30% titanium are not corrosion resistant in hot water or steam. They indicated also that for time periods up to 140 days in water and to 60 days in steam, the alloys of 40 to 50% titanium are generally comparable in corrosion resistance to Zircaloy-2 while those of 60 to 90% titanium are, in this respect, much superior. Over the entire range, corrosion resistance apparently improves with increasing titanium content although the amount of the improvement, for a given increase in titanium, becomes less at higher concentrations of titanium. (auth)

16362 USBM-U-64

Bureau of Mines. [Northwest Electrodevelopment Experiment Station], Albany, Oreg.

HOT WATER CORROSION RESISTANCE OF ZIRCONIUM AND ZIRCALOY 2 MADE USING A HIGH-MANGANESE MAGNESIUM REDUCTANT IN THE KROLL PROCESS. M. D. Carver and E. T. Hayes. Dec. 14, 1955. Changed from OFFICIAL USE ONLY Aug. 28, 1958. 14p. $3.30 (ph OTS); $2.40(mf OTS).

This investigation was undertaken to determine the corrosion resistance of zirconium and Zircaloy-2 made using the regular grade of primary magnesium of the Dow Chemical Company as the reductant in the Kroll process for producing primary zirconium. A change to this reductant from that presently used which is "Nelco" magnesium, a product of the ferrosilicon process, would be economically advantageous were the properties of the resulting products comparable. Zirconium and Zircaloy-2 ingots were cast by double arc-melting sponge. Specimens from the ingots were subjected to hot water corrosion tests. Ingot quality was found to be satisfactory. Manganese content was significantly higher in the alloys from "Dow Regular" magnesium than values ordinarily found for the same alloys from "Nelco" magnesium. Other impurity differences were slight, most values being within limits of Westinghouse specification 11537-E. The results indicated that the hot water corrosion resistance of Zircaloy-2 from the "Dow Regular" magnesium was comparable to that of this alloy from "Nelco" magnesium. The corrosion data for zirconium, however, were inconclusive. (auth)

16363 WAPD-PWR-PMM-1025

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

CORROSION OF EXPERIMENTAL ALUMINUM ALLOYS IN HIGH TEMPERATURE WATER. Report No. 7. I. Cohen. Dec. 21, 1956. 22p. $4.80(ph OTS); $2.70 (mf OTS).

Corrosion data for tests of Al–Fe–Ni alloy in 680°F H_2O–steam, 600°F static H_2O, 680°F circulating H_2O at pH 6.5 to 7.5, and 680°F circulating H_2O at pH 3.5 and 4 with H_3PO_4 are tabulated and discussed. Results from 650°F dynamic water tests at 20 fps and pH 8.5 to 9.0 with NH_4OH and pH 3.5 with H_3PO_4 are included. The data were calculated from results obtained by the iodine–methyl alcohol dissolution method. (T.R.H.)

16364

HOW OXIDATIVE CORROSION OCCURS. Robert V. Jelinek (Syracuse Univ., N. Y.). Chem. Eng. 65, No. 17, 125-30(1958) Aug. 25.

A review of the fundamental principles of electrochemistry is presented. The application of these princi-

ples to oxidative corrosion, including patterns of attack, are discussed. (J.R.D.)

16365

CORROSION OF TITANIUM IN SULFURIC ACID AND CHLORINE. L. W. Gleekman (Wyandotte Chemicals Corp., Mich.). Corrosion 14, 401t-2t(1958) Sept.

Corrosion data show the results of a laboratory test in which commercially pure titanium A-70 was tested in 50% sulfuric acid saturated with chlorine-air mixtures. One sample was totally immersed in the acid, one sample partially immersed, and one sample exposed in the vapor phase. The gaseous mixture ranged from 100% air to 100% chlorine with particular interest being directed to the high chlorine and the high air percentages. The gaseous mixture was added to the acid solution for eight hours continuously during the day; the bottles were then closed off to the atmosphere over night. The test ran for two weeks at room temperature. It is shown that the influence of small amounts of chlorine on the corrosion of titanium in 50% sulfuric acid in that 5% by volume of chlorine in the gaseous mixture reduced the corrosion rate of titanium approximately 100-fold. Larger additions of chlorine did not substantially reduce the corrosion rate. (auth)

16366

CORROSION RESISTANCE OF TITANIUM ALLOYS COMPARED WITH COMMERICALLY PURE TITANIUM. David Schlain and Charles B. Kenahan (Bureau of Mines, College Park, Md.). Corrosion 14, 405t-8t(1958) Sept.

Titanium-8% manganese, titanium-5% aluminum-2½% tin, titanium-2% aluminum, titanium-6% aluminum, titanium-1% copper, and titanium-5% copper alloys are similar to commercially pure titanium in chemical and galvanic corrosion properties. These alloys are completely resistant to corrosion in synthetic ocean water, tap water, 1% sodium hydroxide, and 5% ferric chloride solutions. In sulfuric acid solutions saturated with air, the titanium alloys with the exception of those containing copper are resistant to corrosion in 5% solution at 35°C but corrode rapidly in 10% solution. At 60°C, these alloys are inert in 1% and corrode in 5% acid. The titanium-copper alloys usually are more resistant than commercially pure titanium to corrosion in sulfuric acid solutions and less resistant in hydrochloric acid. In contact with aluminum in 0.5% sulfuric acid saturated with air, titanium and the titanium-base alloys are the cathodic members of the couples. Titanium and titanium-base alloys are generally anodic when in contact with stainless steels in air-saturated 4.7, 9.3, and 17.5% sulfuric acid solutions but the galvanic corrosion rates are low. Furthermore, the chemical corrosion of titanium alloys is almost eliminated as a result of contact with stainless steel. (auth)

16367

THE CORROSION BEHAVIOR OF ZIRCONIUM–URANIUM ALLOYS IN HIGH-TEMPERATURE WATER. Warren E. Berry and Robert S. Peoples (Battelle Memorial Inst., Columbus, Ohio). Corrosion 14, 414t-18t (1958) Sept.

The effect on corrosion behavior of water temperature, uranium content, and oxygen content was determined for zirconium 7 through 70 wt. % uranium alloys. Corrosion rates increased as water temperature increased from 500 to 680°F, as uranium alloy content increased, and in general as oxygen content in the alloys increased. The amount and distribution of epsilon phase present in alloys containing up through 55 wt. % uranium determined their corrosion behavior. The amount of alpha uranium controls the corrosion behavior of alloys containing more than 60 wt. % uranium. Increase in corrosion rates with increasing oxygen in alloys in the epsilon composition range of 45 to 55 wt. % uranium can be correlated with the effect of oxygen on the stability of the epsilon phase. Microstructures reveal an increase of a second phase (alpha zirconium) with increasing oxygen content. (auth)

16368

SOME RELATIONS BETWEEN DEPOSITION AND CORROSION CONTAMINATION IN LOW MAKE-UP SYSTEMS FOR STEAM POWER PLANTS. E. S. Johnson and H. Kehmna (Pacific Gas and Electric Co., San Francisco). Corrosion 14, 429t-34t(1958) Sept.

A mechanism is postulated which indicates that the ratios and interactions of contaminants in low make-up systems of steam power plants are more significant with respect to deposition than the absolute amount of contaminants present. Three examples are cited in support of this theory. It is shown that mechanisms based upon the thermodynamics of the soluble ions from the corrosion of materials of construction can qualitatively account for both the form and composition of the deposits from high purity water in large steam generating stations. Insofar as trouble from deposits is concerned, the ratio of copper to iron seems more important than the absolute concentrations of either. Small variations in the concentration of other ions do not seem to be of any great importance. (auth)

16369

CORROSION OF METALS IN TROPICAL ENVIRONMENTS. C. R. Southwell, B. W. Forgeson, and A. L. Alexander (U. S. Naval Research Lab., Washington). Corrosion 14, 435t-9t(1958) Sept.

Results are reported of 8-year exposure tests made to determine the corrosion characteristics of ten structural steels exposed to seashore and inland environments in the Panama Canal Zone. These corrosion rates are compared with existing data for the same materials in temperate zones. Data reported include a summary of individual analyses of air samples obtained at atmospheric test sites, and extensive weight-loss and pitting data for the ten steels at 1, 2, 4, and 8-year exposure intervals. Numerous time-corrosion curves in tropical marine and tropical inland exposures are given for the steels. Considerable attention is given to the effect of low-alloy additions on mild carbon steel. It was found that the corrosion of copper steel in the two tropical atmospheres was only 13 and 14% less than that of the unalloyed mild steel. The 2 and 5% nickel steels were very effective in resisting corrosion as was nickel steel. The four proprietary low-alloy steels tested displayed good corrosion resistance to tropical atmospheric corrosion. (auth)

16370

A METHOD FOR DETERMINING CORROSION RATES FROM LINEAR POLARIZATION DATA. Milton Stern (Union Carbide Corp., Niagara Falls, N. Y.). Corrosion 14, 440t-4t(1958) Sept.

A method for determining corrosion rate from electrochemical polarization data obtained in the region of the corrosion potential is described. The technique has foundation in theory, is supported by experimental evidence, and appears to have widespread application. The advantages and limitations of the method are discussed. It would appear that the use of linear polarization measurements can supply valuable information regarding: studies of the effect of environment variables on corrosion rate, evaluations of inhibitors in con-

trolling corrosion, comparison of the corrosion rates of various alloys of similar composition in a given environment, and determination of changes in corrosion rate with time, including studies of underground structures as well as materials in aqueous solutions. It also may be possible to use this method in evaluating the condition of coatings in service which cannot be inspected by visual methods. (auth)

16371

THE ELECTROCHEMICAL PROPERTIES AND CORROSION BEHAVIOUR OF TITANIUM IN SULFURIC ACID SOLUTIONS. V. V. Andreeva and V. I. Kazarin (Inst. of Physical Chemistry, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 121, 873-6(1958) Aug. 11. (In Russian)

The corrosion resistance of titanium in solutions of sulfuric acid was investigated. Diagrams were plotted showing the rate of corrosion, potential, and critical anode density of current in various sulfuric acid solutions. (R.V.J.)

16372

ANODIC PROTECTION OF TITANIUM IN SULPHURIC ACID. N. D. Tomashov, R. M. Al'tovskii, and A. G. Arakelov (Inst. of Physical Chemistry, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 121, 885-8(1958) Aug. 11. (In Russian)

Tests were made of the corrosion resistance of titanium in solutions of sulfuric acid with and without anode protection. (R.V.J.)

16373

STUDIES OF THE ANODIC BEHAVIOR OF ALUMINUM. I. THE DIRECTION OF IONIC MOVEMENT. John E. Lewis and Robert C. Plumb (Aluminum Co. of America, New Kensington, Penna.). J. Electrochem. Soc. 105, 496-8(1958) Sept.

It is demonstrated, by a series of marker experiments, in which layers of nonporous anodic oxide were tagged by incorporating radioactive material in them, that nonporous anodic oxide grows at, or close to, the oxide-electrolyte interface; it is concluded that the aluminum ion is the mobile species. Similar experiments with a porous oxide may also be interpreted in terms of formation of the oxide at the oxide-electrolyte interface, but in this case the interface is at the bottom of pores filled with electrolyte. (auth)

16374

STUDIES OF THE ANODIC BEHAVIOR OF ALUMINUM. II. COULOMETRY OF BARRIER LAYER PRODUCTION. Robert C. Plumb (Cambridge Univ., Eng.). J. Electrochem. Soc. 105, 498-502(1958) Sept.

In order to avoid solvent action by the electrolyte during anodic oxidation of aluminum, the electrolyte must have a high buffering capacity. With such an electyte the conversion of aluminum to aluminum oxide is essentially quantitative. The film thickness is proportional to the voltage drop across the film, and the proportionality constant does not depend on the length of time which the voltage is left applied. The film contains, as an essential part of its structure, a quantity of the anion from the electrolyte. The film appears to be nonstoichiometric, having excess aluminum during formation, the amount of excess decreasing with increased length of anodizing time. The coulombic transfer during film formation is quantitatively accounted for during formation by oxidation of aluminum to the trivalent state and liberation of oxygen gas. After the film growth has ceased, the current can be only partially accounted for by oxygen evolution, but it is thought that this is because of difficulty in nucleating oxygen bubbles. (auth)

16375

STUDIES OF THE ANODIC BEHAVIOR OF ALUMINUM. III. THE SPECIFIC SURFACE AREA OF ALUMINUM WITH VARIABLE RESOLUTION FROM 20Å TO 1000Å. Robert C. Plumb (Cambridge Univ., Eng.). J. Electrochem. Soc. 105, 502-6(1958) Sept.

A new technique for studying the surfaces of metals that can be anodically oxidized is proposed. Its development and application for a variety of aluminum surfaces are described. It gives a measure of the specific area of aluminum with what may be described as a continuously variable resolution from 40A to 1000A. The results agree with measurements of specific surface area by a radiochemical technique which has a resolution of about 20A and optical measurements made at resolution greater than 1000A. The shape of a particular surface area vs. resolution curve gives information about the topography of the surface. (auth)

Geology and Mineralogy

16376

URANIUM PRODUCTION FROM LOW-GRADE ORES. Philip Rabone. G. E. C. Atomic Energy Review 1, 223-30(1958) Sept.

The occurrence of uranium minerals and the economics of uranium production from low-grade ores, such as occur in South Africa, are discussed very briefly. The process by which the uranium oxide is extracted from these ores is described in more detail. It comprises acid leaching of the ore, the separation of the uranium from the other constituents in solution by ion exchange, its precipitation, and finally its calcination to the oxide, U_3O_8, in a form suitable for shipment. (auth)

16377

ON THE FORMATION OF FREE HYDROGEN IN THE EARTH CRUST, CAUSED BY THE REDUCING ACTION OF PRODUCTS OF ISOTOPE RADIOACTIVE DECAY. V. P. Savchenko. Geokhimiya No. 1, 14-21(1958).

Hydrogen is produced in the earth's crust by the action of Ca^{40} and Sr^{87} on water. The Ca and Sr are products of the transformation of K^{40} and Rb^{87}. The content of hydrogen and other gases in carnallites and sylvinites in various layers of the Solikamsk mine is given. A theoretical calculation of the gas content from the K^{40} and Rb^{87} content gives results in agreement with the experimental work. The gas contents of various samples from the Berezniki mine are also given. It is shown by these analyses that the hydrogen is produced only by the dissolution of Ca and Sr and that it was not present in elementary form previously. The possible gas contents of rocks formed by the transformations of K^{40}, Rb^{87}, Th^{232}, and U^{235} was calculated. The helium content, theoretically, is of the same order of magnitude as the hydrogen content. (J.S.R.)

16378

AUTOMATIC REDUCTION IN GAMMA-RAY AERIAL SURVEY. A. V. Dmitriyev and V. A. Ionov. Razvedka i Okhrana Nedr No. 4, 31-6(1958).

In gamma-ray aerial surveys, the intensity of the gamma radiation decreases sharply when the gamma rays pass through the atmospheric layers. Therefore, it is necessary to take into consideration the height at which the aerial survey is carried out. Up until now, the registration of the height and of the gamma radiation have been conducted separately, and only by joint laboratory processing could the reduction of the field be ascertained. The introduction of 2 devices, which can be easily installed in existing radiometers, is proposed: an automatic height corrector, by which the

variation of the intensity of gamma radiation at varying heights can be calculated by the King Function, and a device for the automated reduction of the field. These devices will increase the effectiveness of aerial surveying and eliminate complicated laboratory calculations and adjustments. (TCO)

16379
PRELIMINARY GEOLOGIC MAP OF THE MOUNT PEALE 3 NE QUADRANGLE, SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 145. Gordon W. Weir and Chester L. Dodson. Washington, U. S. Geological Survey, 1958. $0.50.

16380
PRELIMINARY GEOLOGIC MAP OF THE VERDURE 4 NW QUADRANGLE, SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 166. Lyman C. Huff and Frank G. Lesure. Washington, U. S. Geological Survey, 1958. $0.50.

16381
PRELIMINARY GEOLOGIC MAP OF THE VERDURE 3 SE QUADRANGLE, SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 167. Lyman C. Huff and Frank G. Lesure. Washington, U. S. Geological Survey, 1958. $0.50.

16382
PRELIMINARY GEOLOGIC MAP OF THE SOUTHWEST PART OF THE CLIFTON QUADRANGLE, WESTON COUNTY, WYOMING. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 180. N. P. Cuppels and F. R. Conwell. Washington, U. S. Geological Survey, 1958. $0.50.

16383
PRELIMINARY GEOLOGIC MAP OF THE CLAY HILLS 2 NE QUADRANGLE, SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 184. Thomas E. Mullens. Washington, U. S. Geological Survey, 1958. $0.50

Metals and Metallurgy

Refer also to abstracts 16189, 16232, 16233, 16430, and 16695.

16384 AECU-3829 and Suppl.
American Metal Climax, Inc., New York.
FINAL REPORT [FOR] APRIL 8, 1957 TO MAY 15, 1958. Allan K. Booth. June 10, 1958. 21p., 5 illus. Supplement, Aug. 11, 1958. 9p. Project No. 802. For Brookhaven National Lab. Contract AT-30-2-gen-16, Subcontract S-330. $7.80(ph OTS); $3.30(mf OTS).

This report and supplement were issued separately, but are cataloged as a unit.

A test program to develop a method and optimum conditions for atomization of Th–Bi solutions producing an uncontaminated product containing $ThBi_2$ platelets is presented. The platelets must be of reasonable uniformity and average ~50μ in their maximum dimension. The program has shown that $ThBi_2$ platelets of the required size and uniformity can be produced by inert gas atomization. The operation of the equipment appeared to be sufficiently trouble free during the final tests to be considered as a system for use as part of the proposed LMFR remotely operated and maintained equipment. (W.L.H.)

16385 AECU-3830
Case Inst. of Tech., Cleveland.
AN INVESTIGATION OF SCALING OF ZIRCONIUM AT ELEVATED TEMPERATURES. Quarterly Status Report No. 21 [for] June 2, 1958 to September 2, 1958. H. B. Probst, E. B. Evans, and W. M. Baldwin, Jr. Sept. 6, 1958. 15p. Contract AT[11-1]-258. $3.30(ph OTS); $2.40(mf OTS).

Single crystals of iodide zirconium were oxidized to determine any lattice relationship existing between zirconium and the oxide overlay, and a review of experimental data and proposed theories to explain the oxidation behavior of zirconium was made. A method of measuring the rate and depth of gas diffusion in alpha zirconium was devised, and calculations were made for the temperature range 900 to 1200°C using samples scaled in air, oxygen, and nitrogen. The consumption rates at lower temperatures were estimated from solutions to the diffusion equation. Distribution of gas during scaling was investigated. In general, breakaway occurs at shorter scaling, and the growth rate increases as the impurity level of zirconium is raised and the scaling atmosphere is changed from oxygen to air. (J.R.D.)

16386 AERE-M/R-1679
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE PRODUCTION OF A STABLE BERYLLIUM POWDER FROM ELECTROLYTIC FLAKE, ITS FABRICATION AND PROPERTIES. J. Williams, W. Munro, and J. W. S. Jones. June 1955. Decl. Sept. 8, 1958. 27p.

The surface contaminant on "aged flake" powder produced by wet milling electrolytic flake in ammonium carbonate contains iron, which derives from attack of the mill and balls by the ammonium carbonate. Leaching in 75% aqueous nitric acid removes the surface film of iron compound, but the sintering behavior of the resultant powder is inferior to that of thermally reduced Brush Q.M.V. powder. A new treatment, which involves leaching dry-milled flake powder with 10% aqueous oxalic acid, reduces the chloride content to ~200 ppm, and yields a powder stable in air. Its fabrication behavior and mechanical properties when fabricated are very similar to the Q.M.V. powder. Rod extruded from this powder has a U.T.S. of 40 ton in^{-2}, a 0.1% proof stress of 20 ton in^{-2}, and 10 to 12% elongation in the direction of extrusion. (auth)

16387 ANL-5749
Argonne National Lab., Lemont, Ill.
PROPERTIES AND HANDLING PRACTICES FOR MAGNESIUM: A LITERATURE SURVEY. M. Breederman, G. A. Bennett, L. Burris, Jr., I. G. Dillon, I. O. Winsch, M. W. Nathans, E. Greenberg, and J. Wolkoff. Mar. 1958. 132p. Contract W-31-109-eng-38. $2.75(OTS).

A survey of Mg including the cost and availability of various high-purity grades, safe handling considerations, methods of distillation and production, physical and thermodynamic properties, and the binary and ternary alloys is presented. A bibliography is included with 157 references. (J.R.D.)

16388 BMI-1278
Battelle Memorial Inst., Columbus, Ohio.
SURVEY OF TERNARY AND QUATERNARY METASTABLE GAMMA-PHASE URANIUM ALLOYS. Victor W. Storhok, Arthur A. Bauer, and Ronald F. Dickerson. July 15, 1958. 38p. Contract W-7405-eng-92. $1.25(OTS).

A survey of the effects of ternary and quaternary alloying on the stability and properties of uranium–zirconium, –niobium, and –molybdenum-base gamma-phase alloys was conducted. The effects of ternary and quaternary additions of chromium, molybdenum, niobium, ruthenium, vanadium, and zirconium on transfor-

mation kinetics, transformation temperature, hot hardness, and corrosion resistance were investigated. Niobium or molybdenum additions to uranium–zirconium-base alloys increased thermal stability and hot hardness of the gamma phase and lowered transformation temperatures. These additions also generally resulted in improved corrosion resistance. Zirconium increased the gamma-phase stability in uranium–niobium-base alloys, lowered transformation temperatures, and in some amounts increased hot hardness and improved corrosion resistance. Variable corrosion behavior of the uranium–niobium–zirconium alloys is probably attributable to lack of homogeneity. Molybdenum additions had either a negligible or detrimental effect on the thermal stability of the uranium–niobium gamma phase, although molybdenum did lower the temperature at which alpha uranium begins to decompose on heating. The addition of 1 wt. % molybdenum to the 10 wt. % niobium alloy or 3 wt. % molybdenum to the 20 wt. % niobium alloy resulted in maximum hardness of the gamma phase at elevated temperatures, the hot hardness decreasing with larger aditions. Generally little effect of molybdenum on the corrosion resistance of uranium–niobium-base alloys was noted, although a 3 wt. % addition was found to increase the corrosion life of the 10 wt. % niobium alloy. Niobium additions of up to 3 wt. % to the 7.5 wt. % molybdenum-base alloy and of 1 wt. % to the 10 and 12 wt. % molybdenum-base alloys increase the thermal stability of the gamma phase; larger niobium additions decreased stability. A possible slight increase in the temperature of gamma formation on heating accompanied the addition of niobium. Ruthenium increased gamma stability more effectively, while it depressed the temperature of transformation to gamma. However, ruthenium decreased the hot hardness of the uranium–molybdenum gamma phase both as a ternary addition and as a quaternary addition to uranium–molybdenum–niobium alloys. Niobium additions to the 7.5 wt. % molybdenum alloy increased hot hardness, while additions above 1 wt. % to the 10 and 12 wt. % molybdenum alloys decreased hot hardness. Ruthenium and niobium additions both increased the corrosion resistance of uranium–molybdenum alloys. Zirconium additions were found to be generally detrimental to thermal stability, hot hardness, and corrosion resistance of the uranium–molybdenum gamma phase, while vanadium and chromium additions exhibited a negligible effect. (auth)

16389 IGR-TN/C-919

United Kingdom Atomic Energy Authority. Industrial Group. Culcheth Labs., Culcheth, Lancs, England.

THE MODES OF DEFORMATION LEADING TO FRACTURE OF METALS: A REVIEW OF PROGRESS TO JANUARY 1958. R. Doldon and R. F. Lumb. May 21, 1958. 9p.

Certain crystals of polycrystalline super-purity aluminum specimens deformed in tension exhibit a banded slip surface. The stress axis of these crystals has been determined and is <123>. Preliminary work has been carried out to determine the suitability of micro-radiography for investigating the effect of strain rate and temperature on the formation and initial propagation of cavities instigated by deformation. Necessary specimen preparation techniques and specialized equipment have been developed. Previous literature on the topic is reviewed briefly. (auth)

16390 KAPL-2000-1

Knolls Atomic Power Lab., Schenectady, N. Y.

REACTOR TECHNOLOGY QUARTERLY REPORT NO. 4. METALLURGY AND MATERIALS. Jan. 1958. 232p. Contract W-31-109-Eng-52. $3.00(OTS).

Fuel Materials. An investigation was conducted to obtain more information on the strain-cycling behavior of U with specific emphasis being placed on those conditions where cyclic straining causes failure in 10 to 1000 cycles. Observations were made of UO_2-containing fuel specimens irradiated at widely varying times, temperatures, and burnups, and the effects of each were determined. The preparation of a 6 wt. % U–Zr alloy containing Pt as a tracer material is presented. Results of bend tests on irradiated fuel element sections are presented. The effect of structure and composition on the irradiation stability of Zr-base dispersion alloy fuel is being studied. Water corrosion testing of a 3.8 wt. % U–Zr alloy was completed for times up to 1400 hr. Corrosion experiments were carried out on ceramic fuels in 680°F waters and burnable poisons under 2000 psi in LiOH at a pH 10 and in NH_3 at a pH of 9. The theoretical and experimental aspects of ultrasonic immersion testing of oval fuel specimens are discussed. Poison Materials. Forming of burnable poison dispersion in ceramic matrices is described. The irradiation stability of several boron compounds and glasses and dispersion systems in which boron compound particles are dispersed in a metallic or ceramic matrix is being studied. The development of dispersion-type reactor poison components composed of neutron-absorbing glass particles as the dispersed phase is discussed. The fabrication of stainless steel–boron alloy irradiation specimens with unbonded and bonded cladding is presented. A summary of the physical, mechanical, and high-temperature water–corrosion properties of a wrought Ag–In–Cd control rod alloy was prepared. Structural Materials. Strain fatigue behavior of Zircaloy-2 and -3 at room temperature and 550°F is presented. The effect of stress pattern on the hydride formation in Zircaloy-2 is presented. The mechanical properties of stainless steel nitrided in sodium are presented. Welding and Brazing. The effects of welding atmosphere and pickling on the corrosion resistance of welded Zircaloy-2 and -3 is presented. Methods of joining Zircaloy-2 to austenitic stainless steel are presented. The diffusion bonding of instrumented fuel element transition joints is described. The mechanical properties of diffusion-bonded joints between Zircaloy and type 304 stainless steel tubing was investigated. A method is presented for welding Ti to Hf. An investigation was made to obtain information on the welding of Ti and Ti alloys containing B. Welded transition joints between type 304 stainless steel and Croloy $2\frac{1}{4}$ after the thermal shock treatments of the joints were evaluated. The inert-gas-shielded consumable electrode or sigma welding process is discussed. The brazing of type 304 to type 304 stainless steel with high-temperature brazing alloys is presented. The corrosion resistance of type 304 stainless steel brazed joints in 680°F water is given. An investigation of the feasibility of diffusion bonding Zircaloy sheets using a stainless steel diffusion layer is presented. (W.L.H.)

16391 LA-2225

Los Alamos Scientific Lab., N. Mex.

FABRICATION OF URANIUM WELDING ROD. E. L. Brundige, G. S. Hanks, and J. M. Taub. Nov. 1, 1957. 37p. Contract W-7405-eng-36. $6.30(ph OTS); $3.00 (mf OTS).

A method of fabricating uranium welding rod from a cast billet by extrusion and swaging has been developed. Optimum results were achieved by extruding the uranium in the gamma phase. Investigation of numerous commercial lubricants resulted in the selection of soft glass wool

as the best. Its use extended die life manyfold and substantially reduced extrusion pressures. The extruded rod was swaged to the desired size and coiled on a graphite mandrel. The coiled wire was then electrolytically cleaned and plated with a 4 to 6 mil coating of silver. The silver plate eliminated oxidation problems during storage and materially reduced oxidation during welding. (auth)

16392 ORNL-2571
Oak Ridge National Lab., Tenn.
AN INVESTIGATION OF HOT DUCTILITY OF INCONEL AND INCONEL X (thesis). Edward A. Pigan. Sept. 19, 1958. 58p. Contract W-7405-eng-26. $9.30(ph OTS); $3.60(mf OTS).

Submitted to the Rensselaer Polytechnic Inst., Troy, N. Y.

This investigation was undertaken to evaluate the effect of the thermal cycles associated with arc welding in Inconel and Inconel X and to find the cause for the change in properties due to the thermal cycles encountered in arc welding through a metallographic study of the fractured specimens. Modifications on the already built hot ductility time-temperature controller provided for the measurement and recording of the load necessary to fracture a specimen. Hot ductility and ultimate tensile strength were determined as a function of peak thermal cycles with ductility increasing to a peak value at 2200°F. At temperatures above 2200°F, ductility decreased sharply until at the embrittling temperature (2450°F for Inconel, 2400°F for Inconel X) ductility reached zero for both alloys. The ultimate tensile strength was found to decrease uniformly with the temperature of testing. For specimens of Inconel fractured on-cooling from 2450°F, the ductility was lowered from the on-heating values but not significantly. The ultimate tensile strength was lowered at the lower temperature of testing but did not vary much from the on-heating values at higher temperatures. Inconel X, on the other hand, exhibited a drastic loss in ductility when the on-heating values are compared to the ductility of specimens fractured on-cooling from 2400°F. Corresponding to the drastic loss in ductility the ultimate tensile strength was substantially lowered for all test temperatures. Hot ductility of Inconel fractured on-cooling from 2400°F did not vary significantly from the on-heating values; tensile strength decreased slightly at temperatures below 2000°F. Inconel X specimens exhibited generally lower ductility values when fractured on-cooling from 2350°F than when tested on-heating. Some reduction of tensile strength is noted at lower temperatures but the values compare favorably at the higher temperatures. The severe loss in ductility of Inconel X is accompanied by gross grain boundary melting. It is possible that melting of the grain boundaries is a factor in hot cracking in the heat-affected zone when Inconel X is welded in large sections. (auth)

16393 SCTM-225-58(16)
Sandia Corp., Albuquerque, N. Mex.
DESIGN AND MATERIALS AS AFFECTED BY ELEVATED TEMPERATURES. D. R. Adolphson. Aug. 5, 1958. 32p. Contract AT(29-1)-789. $1.00(OTS).

A discussion of the influence of elevated temperature on structural design and on mechanical and physical properties of metallic materials is presented. The materials are those which are commercially applicable for structural use up to temperatures of 1200°F including aluminum, magnesium alloys, ferrous alloys, alloy steels, stainless steels, age-hardened stainless steels, and titanium alloys. (J.R.D.)

16394 SEP-248
Sylvania Electric Products Inc. Metallurgical Research Lab., Bayside, N. Y.
THE SELF-DIFFUSION OF NIOBIUM—II. Second Annual Progress Report, July 1, 1957 to June 30, 1958. R. Resnick, L. S. Castleman, and L. Seigle. June 30, 1958. 12p. Contract AT(30-1)-2102. $0.50(OTS).

The self-diffusion coefficient of niobium was measured as a function of temperature. Procedures were developed for the preparation of $NbCl_5$ from a solution of radioactive Nb^{95} in oxalic acid, and the subsequent vapor plating of a radioactive metallic layer from this volatile compound. Initial measurements made at 2000 and 1800°C yield values for the self-diffusion coefficient of 3.2×10^{-9} cm^2/sec and 1.7×10^{-10} cm^2/sec, respectively. (auth)

16395 WADC-TR-58-39
Case Inst. of Tech., Cleveland.
DELAYED FAILURE AND HYDROGEN EMBRITTLEMENT IN TITANIUM. [Period covered] February 3, 1957 to February 3, 1958. R. D. Daniels, R. J. Quigg, and A. R. Troiano. Feb. 1958. 62p. Project title: SOLID STATE RESEARCH AND PROPERTIES OF MATTER. Task title: EFFECT OF ENVIRONMENT ON THE INTERNAL STRUCTURE OF SOLIDS. Contract AF33(616)-5022. (AD-142314).

Hydrogen-induced delayed failure in an alpha-beta titanium alloy (4Al—4Mn) was sensitive to microstructure. A quenched structure was less susceptible to delayed failure than aged or annealed structures. The tendency for delayed failure was magnified in all structures by an increase in hydrogen content or an increase in strength level. Hydrogen-induced delayed failure occurred by a process of crack initiation and controlled crack growth. Delayed failures resulting from creep were also encountered. Plastic strain resulting from creep tended to retard crack initiation. Changes occurring in material under static load prior to formation of cracks were reversible, as long as no appreciable plastic strain occurred, indicating stress-induced diffusion of hydrogen. Hydrogen-induced delayed failure disappeared at both high and low temperatures. The time required for failure as well as the minimum stress at which failure could occur increased at elevated temperatures. (auth)

16396 WADC-TR-58-178
Case Inst. of Tech., Cleveland.
EFFECT OF TEMPERATURE ON THE STATIC FATIGUE CHARACTERISTICS OF HYDROGEN EMBRITTLED 4340 STEEL. E. A. Steigerwald, F. W. Schaller, and A. R. Troiano. Apr. 1958. 25p. Project title: SOLID STATE RESEARCH AND PROPERTIES OF MATTER. Task title: EFFECT OF ENVIRONMENT ON THE INTERNAL STRUCTURE OF SOLIDS. Contract AF33(616)-3431. (AD-155636).

The effect of testing temperatures below room temperature on the static fatigue parameters of a hydrogenated high-strength steel was investigated. The results indicated that the incubation time required for the formation of the first crack in a specimen tested in static fatigue was controlled by the diffusion of hydrogen. The activation energy for this process was 7610 cal/mole. As the test temperature was lowered, the incubation time occupied a greater percentage of the total time to fracture until at −50°F the incubation and fracture times were essentially coincident. The kinetics of crack propagation at subzero temperatures indicated that cracking progressed in a discontinuous fashion. The delayed failure process involves a series

of crack initiations rather than the continuous growth of a single crack. (auth)

16397 Y-1236
Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.
AN AUTOMATIC CONTROL SYSTEM FOR OXYACETYLENE TORCHES. Brandt Kuperstock. Aug. 11, 1958. 14p. Contract W-7405-eng-26. $0.50(OTS).

An electrical control system is described which can perform the following functions: electrically controlled automatic torch light-off; continuous supervision of the flame to insure continued burning; provision for auxiliary conditions being continuously met during flame-on period and electrically controlled automatic extinguishing. (auth)

16398 AEC-tr-3304
DEFECTS IN CRYSTAL STRUCTURE AND PROPERTIES OF METALS. I. Ya. Dekhtyar. Translated by the Oak Ridge National Lab. Library Staff from Uspekhi Fiz. Nauk 62, 99-128(1957). 47p.

A study of a number of properties of metals and melts shows that the same type of defects of an atom have an effect on such processes as diffusion, electrical conductivity, plastic deformation etc. Moreover, a study of these processes in a number of cases made it possible to clarify the nature of the defects of a crystalline structure. A more complete understanding of the mechanism of the indicated processes is possible only after clarifying the interaction of various types of defects. This is important because the properties of the defects determine essentially the actual stability of the metals. (auth)

16399 IGRL-T/C-75
GERMANIUM, INDIUM, NIOBIUM, TITANIUM AND HYDROGEN. H. Hagen and A. Sieverts. Translated by J. Standring (U.K.A.E.A., Culcheth) from Z. anorg. u. allgem. Chem. 185, 225-38(1930). 14p.

The solubility of hydrogen in Ge and In was determined to be no greater than 1 cc H_2 in 100 to 200 g metal. Experiments regarding the absorption of H_2 by Nb revealed the trend of the isotherms and isobars which would be expected from the position of Nb in the periodic table. Formation of gaseous TiH was examined, and it was found that Ti is unable to form a gaseous hydride in accord with Paneth's rule (Z. angew. chemie 36, 407(1923)). (J.R.D.)

16400 IGRL-T/C-87
THE PROTECTION OF THE SURFACES OF METALS WITH HIGH MELTING POINTS TO IMPROVE THEIR ANNEALING PROPERTIES AT HIGH TEMPERATURES. H. Buckle. Translated by R. French (U.K.A.E.A., Industrial Group, Windscale) from Metallforschung 1, 81-6(1946). 10p.

Methods are described for protecting metals which are stable at high temperatures but which scale easily (namely, tungsten, molybdenum, tantalum, and niobium) by treatment of their surfaces. The two main ways of achieving this are: either alloying the metals with those metals which will produce a protective oxide when scaling takes place, or covering the sample from the outset with a protective coating of non-scaling materials, in particular metallic oxides of high melting point. (W.L.H.)

16401 NRL-Trans-659
ENERGY OF ACTIVATION OF THE VISCOSITY OF MOLTEN ALLOYS. (Aktivační Energie Vazkosti Roztavených Slitin.) Antonin Hrbek. Translated for Naval Research Lab., Washington, D. C. from Hutnicke Listy 11, 715-21(1956). 12p.

The activation energy of alloys and its dependence on the composition of the alloys are discussed. Methods of viscosity calculation for molten alloys at any temperature are presented, and equilibrium diagrams are used to judge the effects of molten admixtures on molten alloys by their influence on the melting point and on the isochoric heat capacity. Calculated viscosity energies for various alloys are tabulated. (J.R.D.)

16402
THE RESISTANCE WELDING OF CROSSED WIRES. H. Wängsjö and A. Palmqvist. ASEA Journal 31, 27-36 (1958).

The influence of various factors on the final weld when welding low-carbon steel, the strength of the weld under various load conditions, and the possibility of decreasing the hardness of the weld in the case of high-carbon steel are discussed. The welding of light alloys is briefly discussed. Some practical applications of various types of welding machine for this kind of work are described. (auth)

16403
EFFECT OF POLYGONIZATION ON THE MECHANICAL PROPERTIES OF SOLID SOLUTIONS OF ALUMINUM–ZINC. Pierre Gobin and Jean Montuelle. Compt. rend. 247, 456-8(1958) July 28. (In French)

The effect of the distribution of dislocations on the mechanical properties of aluminum–zinc alloys was studied. Two series of 13% zinc alloys were prepared: one with recrystallization crystals free from substructure by rolling to 75% followed by annealing under vacuum for 12 hours at 550°; the other series with polygonized crystals prepared by the same treatment followed by a 2% elongation and annealing for 3 hours at 450°C. In each of the two series, half were tempered from 450 to 20°C in calm air and the other half were tempered from 450 to 16°C in water. The hardness and mechanical characteristics were determined as a function of the treatment for each of the samples. It was shown that the polygonization blocks almost completely the structural hardening after tempering in air, but it only lessens the hardening after tempering in water. Polygonization also makes the alloy less sensitive to the effect of a static force only slightly less than the elastic limit. With respect to fragility, polygonization acts as a stabilizing factor. (J.S.R.)

16404
EFFECT OF THE COMPOSITION OF CORROSIVE REAGENTS WITH OR WITHOUT COPPER ON THE MICROGRAPHIC ATTACK OF REFINED ALUMINUM. Gérard Wyon. Compt. rend. 247, 458-61(1958) July 28. (In French)

Reagents of fluorinated aqua regia can, according to their composition, give rise to two types of attack. One produces corrosive shapes in geometric form and the other produces numerous microfigures. The addition of a few ppm of Cu ions changes a reagent giving microfigures to one giving geometric figures only in the case of aluminum of ordinary purity. (tr-auth)

16405
THE CALCULATION OF LIMIT VALUES FOR THE ACTIVATION ENERGY OF VARIOUS PROCESSES IN SOLID METALS. K. A. Osipov (Baikov Inst. of Metallurgy, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 121, 637-9(1958) Aug. 1. (In Russian)

In a previous work the hypothesis on the limiting and transitional values of the activation energy for the rearrangement of atoms in metallic solids (such as self-diffusion, plastic deformation, etc.) was formulated. This hypothesis defined the critical conditions for the

thermodynamic instability of atoms in crystals, as the transition from the solid to the liquid phase on crystal modifications. Depending on conditions, different instances of the activated state may appear separately or together. The limited state of thermodynamic instability for an activated group of atoms can appear as the result of heat fluctuation, effects of applied tension, and various radiations. Tables of melting point, heat content, and entropy for various metals and metalloids and the diagram of the dependence of limit values of activation energy on the atomic number of the element are presented. (R.V.J.)

16406

EQUILIBRIUM POTENTIALS OF TITANIUM IN CHLORIDE MELTS. M. V. Smirnov, L. E. Ivanovskii, and N. A. Loginov (Electrochemical Lab., Urals Branch of Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 121, 685-8(1958) Aug. 1. (In Russian)

The electromotive force of $Ti/TiCl_2$, LiCl, KCl(melt)/LiCl, KCl(melt)/8.05% $PbCl_2$, LiCl, KCl(melt)/Pb was measured at 410 to 710° with titanium concentrations of 0.2, 0.32, 0.49, 0.94, 5.3, and 5.7 wt. % (which correspond to concentrations in mole units of 4.66×10^{-4}, 7.45×10^{-4}, 1.14×10^{-3}, 2.19×10^{-3}, 1.25×10^{-2}, and 1.35×10^{-2}). A diagram of electromotive force between titanium and chloride was plotted with empirical equations for 700, 800, 900, and 1000°K. (R.V.J.)

16407

THE VOLUME CHANGE IN VANADIUM IN THE TRANSITION TO THE SUPERCONDUCTIVE STATE. J. Müller (Laboratorium fur Festkörperphysik, Zürich) and H. Rohrer (Institut für kalorische Apparate und Kältetechnik, Zürich). Helv. Phys. Acta 31, 289-91 (1958). (In German)

The volume change in vanadium in the transition to the superconductive state was measured on two samples. The results are graphed and agree with theory within the experimental error. (J.S.R.)

16408

SUPERCONDUCTIVITY IN VANADIUM–CHROMIUM ALLOYS. G. Busch and J. Müller (Laboratorium für Festkörperphysik, Zürich). Helv. Phys. Acta 31, 291-2 (1958). (In German)

Mixed crystals of vanadium and chromium were prepared, and superconductivity measurements were made. The low-temperature measurements were made in a combined helium gas–helium liquid cryostat and included the determination of the magnetic permeability in the 0 field as a function of temperature for various chromium concentrations as well as the observation of the critical magnetic field for the destruction of superconductivity. The transition curve showed that the alloy in the range investigated is single phase. The critical temperature decreases sharply with increasing chromium concentration from 5.29°K for pure vanadium and attains an extrapolated value 0°K at approximately 8% chromium. An interpretation of these results is briefly discussed. (J.S.R.)

16409

THE ELECTRODEPOSITION OF IRON–MOLYBDENUM ALLOYS. L. O. Case and Albertine Krohn (Univ. of Michigan, Ann Arbor). J. Electrochem. Soc. 105, 512-20(1958) Sept.

A plating cell was designed to provide a method for the variable rotation of a cylindrical cathode between rubber wiper blades, since wiping the cathode greatly increased the efficiency of the process for plating iron-molybdenum alloys from a solution containing sodium molybdate, ferric chloride, and sodium pyrophosphate buffered to a pH of 8 with excess sodium bicarbonate. A complete study of the variables showed it possible to electrodeposit alloys which are bright and adherent in thicknesses of a few hundredths of a millimeter. No theoretical treatment is yet available to explain completely this type of deposition. (auth)

16410

ALUMINIUM-RICH ALLOYS OF THE QUATERNARY SYSTEM ALUMINIUM–IRON–COPPER–NICKEL. G. V. Raynor and B. J. Ward (Univ. of Birmingham, Eng.). J. Inst. Metals 86, 135-44(1957) Nov.

The constitution of the aluminum-rich alloys of the quaternary aluminum–iron–copper–nickel system in the solid state at 530°C. was examined by metallographic, x ray diffraction, and electrode-potential measurements. In the composition range investigated, the aluminum-rich solid solution may be in equilibrium with $CuAl_2$, with the ternary compound T(FeCu), or with the ternary compound T(NiCu). By the extrapolation of results obtained at total solute concentrations of 10 and 15 wt. %, the compound T(FeCu) is shown to be capable of dissolving nickel up to a limit, at 530°C., of approximately 6·8 wt. %. The solubility of iron in T(NiCu) is much smaller. Experiments with selected alloys slowly cooled from the melt made possible the preparation of pure samples of T(FeCu), T(NiCu), and T(FeNi) from the appropriate ternary systems and the quaternary system. Chemical analyses confirmed the compositions $FeCu_2Al_7$ and $NiCu_3Al_6$, respectively, for T(FeCu) and T(NiCu), and showed that, in the former, the iron atoms could be replaced by nickel atoms at least up to a nickel content of 6·5 wt. %, in good agreement with results in the solid state. The solubility of iron in T(NiCu) is small; approximately 0.8 wt. %. T(FeNi) can contain little copper in solid solution. The results are discussed briefly in relation to the more recent suggestions with regard to the general nature of aluminum-rich intermetallic compounds formed by aluminum and transition metals of the First Long Period of the Periodic Table. (auth)

16411

THE MECHANISM OF GROWTH OF URANIUM ON THERMAL CYCLING IN THE ALPHA RANGE. S. F. Pugh (Atomic Energy Research Establishment, Harwell, Berks., Eng.). J. Inst. Metals 86, 497-503(1958) Aug.

Uranium bars prepared by rolling in the α range (up to about 670°C) increase in length and decrease in diameter during slow thermal cycling in that range. The amount of growth per unit length per cycle may remain constant for hundreds of cycles or may change slowly. The amount of growth per cycle is a function of the upper cycling temperature and the temperature range of the cycle; it is also a function of the holding time at the upper cycling temperature. Growth on thermal cycling will occur if three conditions are satisfied: (1) The individual crystals of the aggregate undergo anisotropic thermal expansion. (2) A double texture is present in the wrought bars, the component textures having different coefficients of expansion in the axial direction. (3) The relative strength of the two textures in the direction of the axis of the bar changes with change in temperature. Experiments indicate that the first two conditions are fulfilled for α-rolled uranium bar. The alteration in relative strength with temperature implies a change in the mode of deformation, and it has been suggested that there is a change from a yield criterion to a creep process on raising the temperature. This suggestion accords with the known properties of uranium in the α range. Further experiments to determine the internal-stress cycle and the

modes of deformation during a typical cycle are described, and a quantitative account is presented of the internal strains and resulting external growth. This analysis includes a description of the processes leading to a change in growth per cycle when the heating and cooling rates are changed. It is also shown that the mechanism derived by considering the behavior of bicrystals can be used to account for the behavior of polycrystalline aggregates. (auth)

16412

THE SHAPE, SIZE, AND GROWTH OF SOME INTERMETALLIC COMPOUNDS IN LIQUID BISMUTH. P. J. Barton and G. W. Greenwood (Atomic Energy Research Establishment, Harwell, Berks., Eng.). J. Inst. Metals 86, 504-9(1958) Aug.

The shapes and sizes of particles of binary intermetallic compounds of uranium, thorium, cerium, zirconium, magnesium, calcium, strontium, barium, tellurium, and selenium with bismuth have been studied metallographically with respect to their mode of preparation, after isothermal treatment in liquid bismuth, under changes in temperature, and on precipitation from solution. With the exception of Mg_3Bi_2, compounds formed by the reaction of liquid bismuth with the solid element assume an approximately equiaxed form, but when precipitated from solution these compounds (except $BaBi_3$, SeBi, Te_3Bi_2) occur as thin plates; particles are less plate-like when cooling is rapid or when ultrasonic vibrations are applied during precipitation. When nearly equiaxed close-packed particles are held in bismuth at constant temperature, the larger ones grow initially without change in shape at a rate agreeing in order of magnitude with calculations based on the growth of spherical particles. On continued growth, two directions of each crystal (except $BaBi_3$, SeBi, Te_3Bi_2) extend more rapidly than the third. These growth characteristics, as well as the extreme plate-like form occurring on precipitation and the plate thickening which takes place on isothermal soaking, are interpreted in terms of a variation of surface energy with orientation. (auth)

16413

ROUTINE APPARATUS FOR DETERMINING THE SURFACE AREA OF METAL POWDERS. P. Hersch (Arthur D. Little Research Inst., Inveresk, Midlothian, Eng.). J. Inst. Metals 86, 509-11(1958) Aug.

A simplified version of the low-temperature, nitrogen-adsorption technique for determining the specific surface area of metal powders is described. The modified method involves determination of one point only of the adsorption isotherm; the dead space is estimated without the use of helium, and the amount of ancillary equipment required is much reduced. Five or six samples can be measured in one day, by a semi-skilled operator, with results reproducible within ±5%. (auth)

16414

DIFFUSION OF COBALT INTO IRON–COBALT ALLOY. Tokutaro Hirone, Nobuhiko Kunitomi, and Masanobu Sakamoto (Tohoku Univ., Sendai, Japan). J. Phys. Soc. Japan 13, 840-4(1958) Aug.

The diffusivity of cadmium into single crystals of copper has been measured in the temperature range from 725 to 950°C using radioactive isotope Cd^{115} as a tracer. The results indicate that $D_0 = 0.935$ cm^2/sec and $H = 45{,}700$ cal/mol. These values are compared with the corresponding values for the diffusion of zinc into copper in order to investigate the effect of the difference in atomic radii. (auth)

16415

AN ANALYTICAL APPROACH TO THE DIFFUSION BONDING PROBLEM. Louis S. Castleman (Sylvania Electric Products, Inc., Bayside, N. Y.). Nuclear Sci. and Eng. 4, 209-26(1958) Aug.

Attention is focused on the interdiffusional aspects of the diffusional bonding problem as it relates to the fabrication of clad fuel elements and their operation at elevated temperatures. Certain idealized cases of core-cladding interdiffusion occurring in single phase, two-phase, and three-phase systems are examined analytically. In the two-phase and three-phase systems, the importance of the roles played by the boundary and interface concentrations and the diffusion coefficients in controlling interface movement and interdiffusion is evaluated in detail. (auth)

16416

ON THE FATIGUE LIMIT OF METALS. P. Feltham (The University, Leeds, Eng.). Phil. Mag. (8) 3, 806-10(1958) Aug.

Experimental data and theoretical considerations were examined in an effort to determine the temperature independence of σ_f/σ_c (fatigue limit and critical tensile stress). σ_f is correlated with σ_c for 99.99% pure polycrystalline Cu. The equation gives a value of 2.0 and indicates the validity of the temperature-independence hypothesis. However, the collection of additional data is recommended. (D.E.B.)

16417

THE STATIC AND DYNAMIC STRENGTH OF A CARBON STEEL AT LOW TEMPERATURES. C. J. Maiden and J. D. Campbell (Univ. of Oxford). Phil. Mag. (8) 3, 872-85(1958) Aug.

Previous investigations of the effect of temperature on the static and dynamic strength of steel are briefly reviewed. A description is given of tests in which small specimens of a medium-carbon steel were compressed at high rates of strain and at temperatures ranging from 15 to –121°C. Dynamic stress-strain curves obtained from these tests are compared with stress-strain curves obtained from tests at normal rates of strain, at temperatures from 15 to –183°C. The results indicate that the effect on the stress-strain curve of increasing the average strain rate to 600 sec^{-1} is comparable to that of lowering the test temperature to –183°C, the upper yield stress being multiplied some 2½ times and the lower yield strain being increased considerably. The effect of testing at high rates and low temperatures is to raise the curve still further. Metallographic examination shows that the slip occurring in the ferrite at low temperatures and normal rates is finer than that obtained at room temperature; also there is less multiple slip. These characteristics were also observed at high strain rates. No twinning took place in the static tests, even at the lowest temperature. In the dynamic tests, twins were not formed at room temperature, but were formed at the lower test temperatures. (auth)

16418

DISLOCATION LOOPS IN QUENCHED ALUMINIUM. P. B. Hirsch and J. Silcox (Cavendish Lab., Cambridge, Eng.) and R. E. Smallman and K. H. Westmacott (Atomic Energy Research Establishment, Harwell, Berks., Eng.). Phil. Mag. (8) 3, 897-908(1958) Aug.

Electron transmission micrographs of polycrystalline aluminum quenched from ~600°C into iced brine show that the specimens contain many dislocation loops with diameters of the order of several hundred A. Some of the loops are hexagonal in shape, and occur on (111) planes, and have a Burgers vector ½ [110] not in the

plane of the loop. The loops are thought to be produced by the collapse of disks of vacancies, and the corresponding vacancy concentration is 10^{-4}. Some of the loops disappear, while under observation in the microscope, by a mechanism of prismatic slip. In the neighborhood of grain boundaries there is a zone depleted of loops; similar zones are observed near dislocations, whose complex configurations suggest that climb may have taken place. The observations are discussed in relation to the problems of annealing out vacancies, of quench-hardening, and of the origin of the dislocation network. (auth)

16419

THE γ PHASE IN URANIUM ALLOYS. R. G. Loasby (Univ. of Nottingham, Eng.) Proc. Phys. Soc. (London) 72, 425-8(1958) Sept.

Electrical resistivity and magnetic susceptibility properties of two alloys based on γ-uranium are described and interpreted in terms of a theoretical structure derived from x-ray work. The implication of the earlier work, that uranium in the γ form is characterized by only four electrons per atom (as opposed to six for the α and β forms), is supported by the results. (auth)

16420

MAGNETIC PROPERTIES AND STRUCTURE OF Fe WITH 27% V. M. I. Zakharova and P. N. Stetsenko. Vestnik Moskov. Univ. 12, No. 5, 47-52(1957) (In Russian)

Magnetic and x-ray analysis, electron and optical microscopy, and microhardness measurement methods were used in order to determine the structure and magnetic properties of Fe with 27% V. The phase diagram showed that at <1150°C the alloy is in a one-phase state; at reduced temperatures it passes over to a two-phase state ($\alpha + \sigma$). Temperature effects on the magnetic properties of tempered and annealed alloys were investigated. (R.V.J.)

16421

PHASE TRANSFORMATIONS OF Fe–V ALLOYS. M. I. Zakharova and P. N. Stetsenko. Vestnik Moskov. Univ. 12, No. 5, 53-61(1957). (In Russian)

Changes in the structure and properties of Fe with 47% V (corresponding to the stoichiometric composition Fe–V) during phase transitions were investigated by microscopic and x-ray analysis, microhardness, and magnetic measurements. (R.V.J.)

16422

TEMPERATURE DEPENDENCE OF THE HEAT CONDUCTIVITY AND ELECTRICAL RESISTANCE OF Ti, Zr, and Zr ALLOYS. V. E. Mikrukov. Vestnik Moskov. Univ. 12, No. 5, 73-80(1957). (In Russian)

The electric conductivity of iodide and forged Ti doubles between 40 and 500°C and triples in iodide zirconium between 60 and 640°C. The admixture of Hf and C increases the electric conductivity of zirconium. Additions of 0.89% Ta to Zr alloy with 0.97% Hf and 0.3% C and Zr alloy with 0.14% Hf and 0.08% C do not change the electric resistance of the alloys. The heat conductivity of iodide and forged Ti does not vary between 120 and 526°C, and neither does the heat conductivity of iodide Zr and Zr alloys. However, the heat conductivity of iodide Zr is higher than that of Zr alloys. (R.V.J.)

16423

X-RAY ANALYSIS OF GALVANIC IRON–NICKEL ALLOYS. N. S. Fedorova (Mendeleev Moscow Inst. of Chemistry). Zhur. Fiz. Khim. 32, 1211-13(1958). (In Russian)

An x-ray analysis was made of galvanic iron-nickel alloys of six different compositions. Alloys containing 9 and 18% nickel crystallize in a cubic body-centered lattice; alloys containing 52, 64, and 88% nickel crystallize in a face-centered lattice; and the alloy with 31% nickel is a mixture of two phases, body-centered and face-centered cubes. The parameters of the alloy lattice change, depending upon the composition. In a two phase system the lattice parameters of both phases were determined. (tr-auth)

16424

METALLURGY IN THE USSR. L. M. Ivanova, A. Ya. Chernyak, and L. M. Khelemskaya, eds. Moscow, Tsentral'naya politekhnicheskaya biblioteka, 1957. 39p.

A bibliography is presented on the development of metallurgy in the USSR during the last 40 years. 96 references. (J.S.R.)

16425

INDUCTION FURNACES FOR MELTING METALS AND ALLOYS. Samuil Aronovich Farbman and Ivan Filippovich Kolobnev. Moscow, Metallurgizdat, 1958. 704p.

This book, intended as a textbook for students of electrometallurgy and as a practical handbook for production engineers and designers, is concerned with the practical application of the theory of induction heating in melting metals and alloys. All types of induction furnaces and individual aspects of furnace operation are described in detail. Ingot molds and their coatings are also discussed. The melting of metals in vacuum and protective atmospheres and the equipment used for this purpose are described. In the present edition, the 4th, an attempt was made to reflect the progress which has been made in the field of induction furnaces during the last 5 to 6 years, both in the USSR and the rest of the world. (J.S.R.)

PHYSICS

16426 NP-6935

Ansco Div., General Aniline and Film Corp., Binghamton, N. Y.

REDUCTION OF THE EFFECTS OF NUCLEAR GAMMA RADIATION ON PHOTOGRAPHIC SILVER HALIDE EMULSIONS. Final Report [for] January 1, 1956–June 30, 1958. D. A. Nepela and H. F. Nitka. 93p. Contract DA-36-039-sc-70172.

An investigation was undertaken to evolve a photographic material or procedures whereby acceptable ground or low altitude aerial reconnaissance photographs could be taken despite the existence of a high ambient level of gamma radiation. Three approaches were selected as holding the greatest promise for eliminating or reducing the adverse fogging effect of a uniform gamma-ray exposure on the quality of photographs taken in close support operations, including variation of the basic composition of photographic emulsions, chemical and/or optical treatment of the exposed film to erase the effect of undesired gamma radiation, and utilization of special processing and printing techniques. The third approach was the most successful and the most practical. This method employs reversal development, followed by image intensification techniques and/or printing on direct-positive film or paper of extremely high contrast. In this way, acceptable photographs without sacrifice in speed, contrast, or definition can be obtained, in the presence of gamma-ray dosages up to 400 roentgens, on a panchromatic photographic film of an effective exposure index 25. (auth)

16427 TID-2023(Del.)
Technical Information Service Extension, AEC.
NUCLEAR SCIENCE AND TECHNOLOGY. VOL. 2, NO. 3. Dec. 1956. Decl. with deletions June 10, 1958. 41p. $7.80(ph OTS); $3.30(mf OTS).

Three items are included in this issue. Separate abstracts have been prepared for each. (T.R.H.)

16428 TID-2023(Del.)(p.237-48)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
EXPERIMENTS WITH FURFURYL ALCOHOL IN A CRITICAL ASSEMBLY. F. J. Jankowski, D. Klein, and T. M. Miller. p.237-48 [of] NUCLEAR SCIENCE AND TECHNOLOGY. VOL. 2, NO. 3 (deleted). Dec. 1956. 12p.

Experiments have been conducted in a critical assembly in an attempt to simulate the high-temperature operation of a pressurized water reactor by using furfuryl alcohol, an organic material of low hydrogen density, in place of the water moderator. Reactivity changes associated with control-rod bank positions for furfuryl alcohol concentrations of 100, 80, 60, and 40 per cent have been determined and compared with similar measurements conducted on a high-temperature pressurized water reactor. Temperature coefficients have been measured at furfuryl alcohol concentrations of 80 and 63 per cent, combined with previous determinations for pure water, and partially analyzed. (auth)

16429 TID-2023(Del.)(p.277-85)
American Radiator and Standard Sanitary Corp., Redwood City, Calif.
A SYSTEMS ANALYSIS OF REACTOR FEED PREPARATION. David P. Herron. p.277-85 [of] NUCLEAR SCIENCE AND TECHNOLOGY. VOL. 2, NO. 3 (deleted). Dec. 1956. 9p.

The cost of preparing feed for reactors depends upon the price of available uranium ore, diffusion-plant costs for enriching uranium in order to obtain the desired U^{235} concentration, and chemical-conversion costs for uranium in feed-materials plants. There is a minimum-cost procedure for preparing reactor feed of any given concentration. Under certain conditions it is cheaper to blend discharged reactor material with a diffusion-plant side stream to prepare the reactor feed rather than to send all reactor discharge back to the diffusion plant. It is possible to ascertain the most economical method of feed preparation by systems-analysis techniques. (auth)

16430 TID-2023(Del.)(p.286-9)
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
INVESTIGATIONS TO DETERMINE THE CAUSE OF POLYHEDRAL FUEL CONFIGURATIONS IN EXPERIMENTAL FUEL RODS DESIGNED TO PRODUCE ROUND FUEL CONFIGURATIONS. J. G. Goodwin. p.286-9 [of] NUCLEAR SCIENCE AND TECHNOLOGY. VOL. 2, NO. 3 (deleted). Dec. 1956. 4p.

The cause of nonround fuel configurations in fuel rods that were designed to have round fuel configurations has been investigated. The experimental technique used to determine the reasons for such shapes is presented, and methods to prevent their occurrence are discussed. It was found that the nonround fuel configurations are orientation effects from prior fabrication. (auth)

16431 WADC-TR-57-456(Pt. I)
Radio Corp. of America, Camden, N. J.
PRELIMINARY INVESTIGATION OF HYPER ENVIRONMENTS AND METHODS OF SIMULATION. PART I. NATURAL AND INDUCED ENVIRONMENTS ABOVE 75,000 FEET. R. A. DiTaranto and J. J. Lamb. July 1957. 85p. Project title: PRELIMINARY INVESTIGATION OF HYPER ENVIRONMENTS AND METHODS OF SIMULATION. Contract AF33(616)-3915. (AD-142002).

The survey portion of the preliminary investigation of hyper environments and methods of simulation is presented. Conclusions as to the natural and induced environments which will be encountered by future U. S. Air Force weapon-systems and their detrimental effects are included. (T.R.H.)

16432 WADC-TR-57-492(Vols. I and II)
General Electric Co. Specialty Transformer Dept., Fort Wayne, Ind.
ULTRA HIGH TEMPERATURE MINIATURIZED POWER TRANSFORMERS AND INDUCTOR MATERIALS. VOLUMES I AND II. Harold B. Harms and James C. Fraser. May 1958. 475p. Project No. 4155. Contract AF33(616)-3623. (Vol. I, AD-155527; Vol. II, AD-155528).

Contract objectives called for the development of electronic power transformers capable of operation in a 500°C ambient temperature and in intense nuclear radiation. Steps to accomplish them involved evaluation of the transformer basic materials alone, evaluation of combinations of the basic materials in transformers, and the development of ceramic processes and supporting members to give mechanical and moisture protection to the transformers. Tests were performed under combined high-temperature and radiation conditions. Mechanical tests were also combined with high temperatures. Results of the materials tests indicated that mica paper, glass served silver wire and grain oriented silicon steel are prominent among materials having adequate properties for use in electronic power transformers in the specified environments for a 1000 hr aging period. Life test results showed that these materials can perform their intended functions when assembled together as transformers. The feasibility of an encapsulated protective technique using a thin ceramic coating in conjunction with a stainless steel mesh was established. Further development, however, is required to make best use of the ceramic material. An hermetic protective device gives the required environmental resistance, although this type of construction has a weight disadvantage. There is tentative indication that the effects of combined nuclear radiation and temperature environments on both materials and transformers are primarily caused by temperature. An exception to this appears to be with the dielectric breakdown strength of air. (auth)

16433
DIELECTRIC BREAKDOWN IN SOLIDS. J. J. O'Dwyer (Commonwealth Scientific and Industrial Research Organization, Chippendale, Australia). Advances in Phys. 7, 349-94(1958) July.

An account is given of the theories of intrinsic dielectric breakdown in solids, with particular emphasis on the physical process envisaged by each theory. Theories of the modified form of thermal breakdown which occurs in impulse testing are also discussed. (W.D.M.)

16434
ABSORBANCE OF LIQUID WATER AND DEUTERIUM OXIDE BETWEEN 0.6 AND 1.8 MICRONS. COMPARISON OF ABSORBANCE AND EFFECT OF TEMPERATURE. W. C. Waggener (Oak Ridge National Lab., Tenn.). Anal. Chem. 30, 1569-70(1958) Sept.

The 10 cm absorbances of water and deuterium oxide were compared as a function of temperature from 0.6 to 1.8 μ. The results indicate that measurements of aqueous absorption spectra of metallic ions

may be extended into the infrared by a factor of 1.4 in wave length by changing from light to heavy water media. (auth)

16435

TESTING INHIBITED TRANSFORMER OILS. G. Ericson. ASEA Journal 31, 16-21(1958).

A number of methods suitable for testing inhibited transformer oils are described, and the results of the investigations are used to illustrate these methods. In this connection, results obtained elsewhere from accelerated aging tests in service, which have been published in the technical literature, are discussed. (auth)

16436

ELECTRICAL RESISTANCE HEATING. S. Nordin. ASEA Journal 31, 47-53(1958).

Electrical resistance heating is arranged by passing a current directly through the work-piece. The current is selected according to the resistance so that the desired degree of heating is obtained at the appropriate time. The theory of electrical resistance heating is discussed and an account of several normal types of machine is given. The advantages and disadvantages of the method are set out. (auth)

16437

SILICON PHOTOCELLS AS SOLAR ENERGY CONVERTERS. V. S. Vavilov, G. N. Galkin, and V. M. Malovetskaya. Atomnaya Energ. 4, 571-5(1958) June. (In Russian)

Properties of p-n transitions, obtained by means of thermal diffusion of phosphorus in p-type silicon, were investigated. Data are presented on charge and spectral characteristics of silicon photoelements with p-n transitions and on the performance with high-intensity exposure. (tr-auth)

16438

THE INFLUENCE OF THE MARTENSITIC TRANSFORMATION ON THE ELECTRICAL RESISTANCE OF SODIUM. D. Gugan and J. S. Digdale (National Research Council, Ottawa). Can. J. Phys. 36, 1248-50(1958) Sept.

Recent experiments have shown that the martensitic transformation can affect many of the thermodynamic, mechanical, and electrical properties of rhodium. Consequently a more careful study of the low-temperature electrical resistance of sodium was made, and some results are reported between 4 and 100°K as a function of both decreasing and increasing temperature. (L.T.W.)

16439

NATURE AND FORMATION PROCESS OF THE SHOCK WAVE FORMED BY THE DETONATION OF AN EXPLOSIVE. Jean Kieffer, Jean Dapoigny, and Boris Vodar. Compt. rend. 247, 577-80(1958) Aug. 4. (In French)

According to the nature of the explosive and the substance, two different mechanisms can arise in the shock wave. In gaseous mixtures, the "superdetonation" wave appears as soon as the pressure exceeds a few hundred atmospheres. In solid media, on the other hand, it is sometimes practically unattainable because of the prohibitive pressure needed, and sometimes it is suppressed. (tr-auth)

16440

He^3–H^3 MEASUREMENTS IN A STONE METEORITE. J. Geiss, H. Oeschger, and P. Signer (Univ. of Bern). Helv. Phys. Acta 31, 322-3(1958). (In German)

The He^3 and tritium content in the Chondrit Monte das Fortes, which fell in 1950, was measured. The tritium was measured with a proportional anticoincidence counter, and the He^3 was determined by the isotopic dilution method. The results are tabulated and compared with the results obtained in the analysis of the Achondrit Norton County. (J.S.R.)

16441

ISOTOPE ANALYSIS OF OSMIUM IN THE HENBURY METEORITE. J. Geiss, B. Hirt, and P. Signer (Univ. of Bern) and W. Herr and E. Merz (Max-Planck-Institut für Chemie, Mainz). Helv. Phys. Acta 31, 324-5(1958). (In German)

Since the half life of Re^{187} is known with great accuracy, the Re^{187}–Os^{187} decay was used in the study of meteorites. The osmium was extracted, and the Os^{187}/Os^{186} ratio was determined to be 1.128 ± 0.03. However, a determination of this ratio for terrestrial osmium gave results which differed from those obtained previously. Therefore, the significance of the osmium isotopic ratio in the Henbury meteorite is uncertain. (J.S.R.)

16442

ERROR IN TEMPERATURE MEASUREMENT DUE TO THE INTERDIFFUSION AT THE HOT JUNCTION OF A THERMOCOUPLE. A. J. Mortlock (Atomic Energy Research Establishment, Harwell, Berks., Eng.). J. Sci. Instr. 35, 283-4(1958) Sept.

Temperature measurement errors due to interdiffusion at the hot junction of a thermocouple are discussed and corresponding theoretical expressions derived. Applying these it is found, for example, that a platinum/platinum–13% rhodium thermocouple in a gradient of 10° C/cm may be in error to the extent of about 1.3°C at all temperatures within the normal operating range following a heat treatment equivalent to 100 days at 1500°C. This is so only if the thermocouple is used in the conventional way with its arms parallel. If the same thermocouple were operated with its arms arranged in an antiparallel fashion, the error would be less. (auth)

16443

MEASUREMENTS OF THERMOELECTRICITY BELOW 1°K.–II. D. K. C. MacDonald, W. B. Pearson, and I. M. Templeton (National Research Council, Ottawa). Phil. Mag. (8) 3, 917-19(1958) Aug.

An initial survey of the alkali metals was completed. The thermoelectric power of lithium is positive and linear with temperature to about 0.05°K; cesium remains positive to about 2°K and varies linearly with temperature below 1°K. The limiting theoretical expression for potassium and sodium regarding thermoelectric power is listed, and it is pointed out that the dependence on temperature appears to be more or less quadratic in contrast to the equation. (J.R.D.)

16444

THEORY OF SPUTTERING BY HIGH-SPEED IONS. David T. Goldman and Albert Simon (Oak Ridge National Lab., Tenn.). Phys. Rev. 111, 383-6(1958) July 15.

The theoretical treatment of ion sputtering at energies above about 50 kev is simplified by the fact that the emergent particles originate at depths in the material which are small compared to the range of the incident particles. The displacement rate is nearly constant over this region and this enables one to obtain relatively simple solutions of the diffusion problem for emission. The emission problem is reduced to an effective one-velocity diffusion calculation by an artifice. The volume displacement rate is increased by the factor $\bar{\nu}$, where $\bar{\nu}$ is the average number of secondaries, and the macroscopic absorption and scattering cross sections are adjusted to make the average number of collisions of each particle equal to the actual average over the secondaries. The resultant sputtering ratio, R,

varies with incident energy E, incident angle ψ, and mass ratio $\mu = M_1/M_2$ (where M_1 = mass of incident particle, M_2 = mass of target particle), as $R \propto \mu(\ln E/E) \sec\psi$. (auth)

16445

ULTRASONIC ATTENUATION AND DISPERSION IN METALS AT LOW TEMPERATURES. M. S. Steinberg (Stevens Inst. of Tech., Hoboken, N. J.). Phys. Rev. 111, 425-9(1958) July 15.

The effect of conduction electron transport on the propagation of acoustic waves in normal metals is investigated at all frequencies. For the attenuation, comparison is made with the kinetic analysis of Pippard and with the measurements of Bömmel. The fractional shift in the velocity of sound is found to be positive and very small. (auth)

16446

MEASUREMENTS OF SHORT LIFETIMES OF NON-EQUILIBRIUM CURRENT CARRIERS IN GERMANIUM. K. D. Glinchuk, E. G. Miselyuk, and A. I. Skopenko. Pribory i Tekh. Ekspt. No. 2, 62-4(1958) Mar.-Apr. (In Russian)

The short lifetimes of non-equilibrium current carriers in germanium ($\tau \lesssim 0.5$ μsec) were measured using the transient characteristics of the point triode collector during the saturation process. Data on the applicability of germanium conductivity modulation for this purpose are given. (tr-auth)

16447

THE ELECTRICAL CONDUCTIVITY AND HALL EFFECT OF SILICON. E. H. Putley and W. H. Mitchell (Royal Radar Establishment, Malvern, Worcs., Eng.). Proc. Phys. Soc. (London) 72, 193-200(1958) Aug.

The electrical conductivity and Hall effect were measured over the temperature range 20 to 500°K on single crystals of silicon with extrinsic carrier concentrations between 2 and 5×10^{12} cm^{-3}. The Hall mobility for electrons and holes can be represented between 100 and 300°K by the expression $1.2 \times 10^8 T^{-2}$ and $2.9 \times 10^9 T^{-2.7}$, respectively. Both these results indicate a higher Hall mobility than has been previously reported, and the result for holes is greater than values reported for the drift mobility. From the results between 350 and 500°K the expression $n_i = 3.10 \times 10^{16} T^{3/2} \exp -0.603/kT$ was obtained for the intrinsic concentration. Attempts were made to estimate the total impurity concentration in these specimens. The variation of extrinsic carrier concentration with temperature and the effect of impurity scattering at 20°K both indicate that the total concentration of impurities is less than 10^{14} cm^{-3}. (auth)

16448

THE MAGNETIC SUSCEPTIBILITIES OF ALLOYS OF CERIUM WITH THORIUM. L. F. Bates and M. M. Newmann (Univ. of Nottingham, Eng.). Proc. Phys. Soc. (London) 72, 345-52(1958) Sept.

The paramagnetic susceptibilities of 90, 71, 60, 42, 20, 10, and 5 atomic per cent cerium in thorium alloys have been measured over the temperature range 90 to 700°K. The temperature dependence of the resistivity of 90, 60, 40, 20, and 5 atomic per cent cerium–thorium alloys has been investigated over the range 90 to 293°K. The thermal expansion of the 60% alloy has also been measured over this temperature range. All the alloys exhibit a sharp decrease in susceptibility at low temperatures. This has been attributed to the excitation of some of the 4f electrons of the cerium atoms into the conduction band at these temperatures, and the resistivity and expansion results support this hypothesis. Above room temperature the susceptibilities of all the alloys obey a Curie–Weiss law, $\chi = C/(T - \theta)$, over at least part of the temperature range. The effective magnetic moments per cerium atom calculated from the Curie constants C increased with decreasing cerium content. A model has been proposed in which coupling between the cerium f electron and the conduction electrons causes polarization of the latter in the neighborhood of the cerium atoms. The apparent increase in P_{eff} is attributed to this induced moment. (auth)

16449

POSITIVE ION EMISSION FROM METAL SURFACES CAUSED BY ION BOMBARDMENT. A. Riddoch and J. H. Leck (Univ. of Liverpool). Proc. Phys. Soc. (London) 72, 467-74(1958) Sept.

The phenomenon reported in this paper was first observed during an investigation into the adsorption of gas on to metal surfaces. When tungsten targets were bombarded with positive ions of the noble gases, and subsequently degassed by heating, a positive ion emission was often observed in addition to a desorption of gas from the target. These ions have been analyzed with a mass spectrometer and shown to be sodium, potassium, rubidium, and cesium. This is reasonable, as these elements form significant impurities in tungsten and may, because of their low ionization potential, be expected to desorb mainly as ions. In view of the results it is certain that these ions also originate from impurities already present in the target before the bombardment took place, rather than directly from the adsorbed ions. (auth)

16450

EXPERIMENTS ON THE FLOW OF HEAT IN LIQUID HELIUM BELOW 0.7°K. R. W. Whitworth (Univ. of Cambridge, Eng.). Proc. Roy. Soc. (London) A246, 390-405(1958) Aug. 19.

A series of experiments has been performed to study the steady flow of heat in liquid helium in tubes of diameter 0.05 to 1.0 cm at temperatures between 0.25 and 0.7°K. The results are interpreted in terms of the flow of a gas of phonons, in which the mean free path λ varies with temperature, and may be either greater or less than the diameter of the tube d. When $\lambda \gg d$ the flow is limited by the scattering of the phonons at the walls, and the effect of the surface has been studied, but when $\lambda \ll d$ viscous flow is set up in which the measured thermal conductivity is increased above that for wall scattering. This behavior is very similar to that observed in the flow of gases at low pressures, and by applying kinetic theory to the problem it can be shown that the mean free path of the phonons characterizing viscosity can be expressed by the empirical relation $\lambda = 3.8 \times 10^{-3} T^{-4.3}$cm. (auth)

16451

DENSITY OF THE NORMAL COMPONENT FOR SOLUTIONS OF He^3 AND He^4. S. K. Trikha (Delhi Univ.). Progr. Theoret Phys. (Kyoto) 19, 346-8(1958) Mar.

The ratio of the density of the normal fluid to the density of the solution at its λ-temperature was calculated as a function of absolute temperature. The linear and quadratic expressions for Gibb's function were used for pure He^4, and $\mu/M_3 = 2.17$, as required to explain the second sound velocity measurements, was used for solutions. (W.D.M.)

16452

ON THE FORM FACTOR OF LIQUID He^4 AT ABSOLUTE ZERO. II. Ryuzo Abe (Tokyo Inst. of Tech.). Progr. Theoret. Phys. (Kyoto) 19, 407-420(1958) Apr.

A refinement of the approximations made in I is

carried out and it is shown that the contradictions concerning the behaviors of the form factor S(k) near k = 0 involved in the previous treatment can be removed. An integral equation for S(k) is solved numerically for the hard-sphere potential and for the modified Lennard-Jones potential. These solutions are compared with the experimental data. Under the approximations, the cohesive energy is shown to be expressed as a function of the sound velocity and S(k), and is calculated using the theoretical and the experimental value of S(k), respectively. The method is applied to a dilute hard-sphere system and the results are compared with corresponding exact solutions. (auth)

16453

SIMULTANEOUS UTILIZATION OF MAGNETIC DEFLECTION AND COULOMB SCATTERING IN THE ESTIMATE OF PARTICLE MOMENTA. Y. B. Kim (Univ. of Washington, Seattle). Rev. Sci. Instr. 29, 680-8(1958) Aug.

The problem of estimating particle momenta under the simultaneous presence of magnetic deflection and Coulomb scattering is considered. This problem is of practical interest when nuclear emulsion plates are exposed under fields of multihundred kilogauss currently available from pulsed magnets. The estimation of momentum is separated into two parts, each utilizing the magnetic and the Coulomb effect, respectively. In this way one can fully utilize the numerous estimation techniques already developed and available in the literature for each of these two estimates. This separation, however, is carried out in such a way that the magnetic and the Coulomb estimate are statistically independent, and hence can be readily combined for an improved accuracy. (auth)

16454

MEASUREMENT OF MAGNETIZATION CURVES IN HIGH PULSED MAGNETIC FIELDS. I. S. Jacobs and P. E. Lawrence (General Electric Research Lab., Schenectady, N. Y.). Rev. Sci. Instr. 29, 713-14(1958) Aug.

An extension of familiar techniques in magnetic measurements has been made enabling the direct measurement of magnetization curves, M vs. H, in high pulsed magnetic fields ($H \gtrsim 100$ koe). The sample is placed in the most spatially uniform region of the available field, inside one of a pair of balanced and opposing pickup coils. Their output is integrated and displayed on the vertical deflection plates of an oscilloscope as M, while the integrated output of the empty coil appears on the horizontal plates as H. As presently operated, a magnetization M of ~30 emu or a volume susceptibility of $\sim 5 \times 10^{-4}$ can be detected with reasonable but not high accuracy. The method is better suited to nonlinear magnetization curves than those methods which involve placing the sample in an inhomogeneous field, and hence may be useful in studying metamagnetics and weak antiferromagnetics. (auth)

16455

DETERMINATION OF THE QUANTITY OF AN ELEMENT INTRODUCED BY ABSORPTION INTO A NUCLEAR EMULSION. Giovanna Mayr (Univ. of Milan). Ricerca sci. 28, 985-93(1958) May. (In Italian)

A method is described to define the amount of an element introduced by absorption in a nuclear emulsion in an easier way than by the usual chemical or microchemical analysis. At the same time the possibility is shown to know easily the dependence of this amount from the experimental conditions in order to obtain the maximum yield in loading. The conditions for reaching a satisfactory precision degree are given. (auth)

16456

INTRODUCTION OF PHOSPHORUS INTO NUCLEAR EMULSIONS BY MEANS OF ABSORPTION. Giovanna Mayr (Univ. of Milan). Ricerca sci. 28, 1205-10(1958) June. (In Italian)

By means of a method already described, the conditions have been studied for obtaining the maximum yield in loading nuclear emulsions with P, ensuring a satisfactory photographic response. (auth)

16457

THE OPTICAL PROPERTIES OF CHROMIUM. Robert M. Hill and Charles Weaver (Royal Coll. of Science and Tech., Glasgow). Trans. Faraday Soc. 54, 1140-6(1958) Aug.

An investigation into the optical properties of chromium is described, using the polarimetric technique. The results obtained show disagreement with the previously published values. It is suggested that this may be due to the presence of a polish, or oxide, layer on the specimens' surfaces. The refractive index of bulk chromium was measured as 1.18–i1.06 for light of wavelength 5461 A. The surface film on a polished bulk metal specimen was found to have a refractive index of 2.42, and a thickness of 50 A. A thick evaporated specimen of the same metal was found to give similar metallic values, and to sustain a surface film of the same thickness but of refractive index 2.23. (auth)

16458

ON ELECTROMAGNETIC WAVES IN ISOTROPIC AND CRYSTALLINE MEDIA WITH ACCOUNT OF SPATIAL DISPERSION OF THE DIELECTRIC PERMEABILITY. V. L. Ginzburg (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 1593-1604(1958) June. (In Russian)

The tensor of dielectric permeability ϵ_{ik} is usually considered to be a function of only the frequency. Thus the spatial dispersion, that is, the dependence of ϵ_{ik} on wavelength is neglected. However, even for a nongyrotropic medium spatial dispersion should be taken into account in the case of sufficiently small absorption in the region in which the refractive index rapidly increases and tends to infinity if dispersion and absorption are neglected. Account of spatial dispersion is also important in the analysis of longitudinal (plasma) waves which are propagated in an isotropic medium or along the principal dielectric axes in crystals. Spatial dispersion, moreover, leads to weak optical anisotropy in cubic crystals. Besides the topics mentioned above the problem of collective (discrete) energy losses of electrons in solids is also discussed. (tr-auth)

Aerosols

16459 AECU-3810 and Add.

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

SCAVENGING OF PARTICULATE MATTER IN CONNECTION WITH NUCLEAR-POWERED SHIPS. Progress Report No. 3 [for] March 15 to June 15, 1958. John Rosinski. 13p. Addendum. 4p. ARF Project C 119. Contract AT(11-1)-586. $3.30(ph OTS); $2.40 (mf OTS).

This report and addendum were issued separately, but are cataloged as a unit.

Coagulation of aerosols was studied by exploding gold

wires and determining the coagulation constant. Studies of the coagulation of mixed fission products suspended in a liquid phase by various coagulants and flocculants are also described. Results in the latter study using permanganate and ferrous salt as scavenger are described in an addendum. (T.R.H.)

Cosmic Radiation

16460

PRODUCTION OF HARD SHOWERS IN LITHIUM BY CHARGED PARTICLES OF COSMIC RADIATION. M. Gribi, F. Heinrich, H. Loeliger, J. M. Pictet, A. Rytz, H. Waffler, and M. Walter (Univ. of Zurich). Helv. Phys. Acta 31, 315-17(1958). (In German)

The showers produced by high-energy protons at 3450 m in a lithium block placed directly over a cloud chamber were photographed. The integral multiplication distribution of showers from lithium was experimentally determined as 2.85. The average energy of the π component of the showers is shown as a function of the multiplication. Within the statistical limits for lithium, the best value of the slope of the total frequency distribution is $\gamma = -1.35$. (J.S.R.)

16461

AN EXPERIMENTAL STUDY OF EXTENSIVE AIR SHOWERS. Saburo Miyake, Kensaku Hinotani, Tatsunosuke Kaneko, and Itsuo Katsumata (Osaka City Univ.). J. Phys. Soc. Japan 13, 782-93(1958) Aug.

An observation of extensive air showers was performed at Mt. Norikura (2840 m above sea level and 25°N geomagnetic latitude) with two multiplate cloud chambers, 90 sparsely distributed G-M counters and two sets of counter hodoscopes. In this experiment, the structure of the air shower in the neighborhood of the shower axis was investigated. Integral size spectrum was obtained as $6.1 \times 10^{-9}(N/10^5)^{-1.5}$ cm^{-2} sec^{-1} sr^{-1} for the showers with a total number of particles $1.5 \times 10^5 - 5.5 \times 10^5$ and for large size showers the exponent of the spectrum increases with shower size reaching about -1.9 at $N = 10^6$. (auth)

16462

OBSERVATIONS ON EXTENSIVE AIR SHOWERS. VI. THE RATIO OF THE SOFT TO PENETRATING COMPONENTS AND THEIR ATTENUATION IN THE ATMOSPHERE. T. E. Cranshaw, J. F. de Beer, W. Galbraith, et al. (Atomic Energy Research Establishment, Harwell, Berks., Eng.). Phil. Mag. (8) 3, 811-25(1958) Aug.

Measurements were made of the ratio of μ-mesons to electrons as a function of shower size and barometric pressure for showers containing about 5×10^6 particles at sea level. The change of rate with atmospheric pressure and temperature is also described, and it is shown how, on the assumption that all showers suffer the same attenuation, these measurements yield the attenuation lengths of electrons and μ-mesons. At each stage, the measurements are compared with the results of other experiments, and finally with various theories of the nucleon cascade. It is shown that none of the theories fits the data well, and that one may suspect the assumption of similar attenuation for all showers. Possible mechanisms giving rise to a distribution of attenuation lengths are briefly discussed, and a case made for an experimental investigation of this point. (auth)

16463

OBSERVATIONS ON EXTENSIVE AIR SHOWERS. VII. THE LATERAL DISTRIBUTION OF ENERGY IN THE ELECTRON-PHOTON COMPONENT. N. A. Porter, T. E. Cranshaw, J. F. de Beer, A. G. Parham, and A. C. Sherwood (Atomic Energy Research Establishment, Harwell, Berks., Eng.). Phil. Mag. (8) 3, 826-30 (1958) Aug.

The energy density of the electron–photon component was measured at distances of 60 to 500 meters from the axis of showers containing 3×10^6 particles at sea level. The mean electron energy appears to be constant, and close to the critical value of 84 Mev, over this region. A lower limit for the energy appearing in the soft component of these showers at sea level is set at 6×10^{14} ev. (auth)

16464

COSMIC RAYS IN THE EARTH'S MAGNETIC FLUID. P. Rothwell (Imperial Coll., London). Phil. Mag. (8) 3, 961-70(1958) Sept.

It is shown that the values of cosmic ray cut-off momenta in the earth's magnetic field, observed at many different places, are generally close to the values calculated from Störmer's theory for the motion of charged particles in a dipole field, if the usual center dipole of the earth is replaced in the Störmer equation by a dipole whose magnitude and direction are determined by the surface field at the place considered. An empirical expression for the actual cut-off momenta (in terms of the center-dipole field, and the 'surface field' cut-off momenta) is deduced from the variation in sea-level nucleon intensity between London and Cape Town, and gives good agreement with experimental results over a wide range of latitudes and longitudes. It is concluded that discrepancies between center dipole predictions and experimental observations of cosmic ray intensities and cut-off momenta are due to differences between the earth's real field and the dipole approximation to it, rather than to distortion of the earth's outer magnetic field by ionized interplanetary matter. (auth)

16465

"RADIATION BELT" AND TRAPPED COSMIC-RAY ALBEDO. S. F. Singer (Univ. of Maryland, College Park). Phys. Rev. Letters 1, 171-3(1958) Sept. 1.

The existence of a belt of unidentified ionizing radiation observed by the Explorer satellites has led to speculations concerning the nature and source of this radiation. The suggestion that the radiation is related to auroral particles accelerated by hydromagnetic waves is discussed. Some earlier work on cosmic-ray albedo trapped in the geomagnetic field is applied with the possibility of accounting for the satellite observations. (W.D.M.)

16466

CORRELATION OF COSMIC-RAY INTENSITY AND SOLAR ACTIVITY. H. V. Neher (California Inst. of Tech., Pasadena) and S. E. Forbush (Carnegie Inst. of Washington). Phys. Rev. Letters 1, 173-4(1958) Sept. 1.

The following relations are pointed out: The yearly averages of the ionization data at Huancayo correlate very well with the average value of the ionization measured at 90,000 ft at Thule, Greenland and there is also a very good anti-correlation with solar activity as measured by the yearly average of Zurich sunspot numbers for the same period. (W.D.M.)

16467

TRAPPED ALBEDO THEORY OF THE RADIATION BELT. S. F. Singer (Univ. of Maryland, College Park). Phys. Rev. Letters 1, 181-3(1958) Sept. 1.

A theory is described for the radiation belt of the earth which gives the energy spectrum, angular distribution, and intensity of the radiation with distance from the earth.

The results are not compatible with data reported by Explorer satellites I and III but are compatible with preliminary reports from Explorer IV. (W.D.M.)

16468

DISTRIBUTION OF K-MESONS PRODUCED IN HIGH ENERGY NUCLEAR INTERACTIONS. S. N. Biswas (Univ. of Adelaide, South Australia). Proc. Phys. Soc. (London) 72, 169-81(1958) Aug.

As an example of the application of the K-meson production cross section, the K-meson component in extensive air-showers was considered. A cascade theory of the cosmic-ray shower was developed embracing the fact that the heavy mesons and hyperons cascade in the nucleus in a manner analogous to the pions and nucleons. Numerical results for the nucleons, pions, hyperons, and the K-meson components in the longitudinal development of the cosmic-ray air shower are presented and compared with available experimental data. (auth)

16469

ON A POSSIBLE MODE OF DEVELOPMENT OF BROAD ATMOSPHERIC SHOWERS. N. L. Grigorov, and V. Ya. Shestoperov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 34, 1539-47(1958) June. (In Russian)

The development of extensive atmospheric showers is examined under the assumption that the fraction of energy lost in the interaction of ultra-high energy particles with light nuclei strongly fluctuates. It is shown that the main features of extensive air showers can be explained without making recourse to the hypothesis that the nuclear component plays an important role in development of the showers in the depth of the atmosphere. (tr-auth)

16470

ENERGY SPECTRA OF NUCLEO-ACTIVE PARTICLES IN WIDE ATMOSPHERIC SHOWERS. O. I. Dovzhenko, O. A. Kozhevnikov, S. I. Nickol'skii, and I. V. Rakobol'skaya (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 1637-8(1958) June. (In Russian)

Nuclear interactions were measured for 52 incidents at 3860-m elevation. The integral energy spectrum was plotted, and the absolute density of 2 to 50 Bev particles in the interval 0 to 9 m from the axis was determined. (R.V.J.)

Crystallography and Crystal Structure

16471

THE CRYSTAL STRUCTURE OF $NbCl_5$. Allan Zalkin and Donald E. Sands (Univ. of California, Livermore). Acta Cryst. 11, 615-19(1958) Sept.

$NbCl_5$ crystallizes in the monoclinic system with a = 18.30, b = 17.96, c = 5.888 A, β = 90.6°. The space group is C2/m, and there are 12 $NbCl_5$ units in the unit cell. The structure consists of dimers (Nb_2Cl_{10}) with the chlorine atoms forming two octahedra which share a common edge. The niobium atoms occupy the centers of the octahedra and are joined by two chlorine bridge bonds. The Nb—Cl bridge bond length is 2.56 A; the Nb—Cl non-bridge bond lengths are 2.25 and 2.30 A. $NbBr_5$ and $TaCl_5$ appear to be isomorphous with the above structure. (auth)

16472

THE ELECTRON MICROSCOPY OF CRYSTAL LATTICES. J. W. Menter (Tube Investments Research Labs., Hinxton Hall, Cambridge, Eng.). Advances in Phys. 7, 299-348 (1958) July.

A summary of progress made in the electron microscopy of crystal lattices is presented. The present status of the instrument, surface methods of studying molecular detail, observation of crystal lattices by direct transmission, and indirect resolution of lattices by means of Moiré patterns are reviewed. (W.D.M.)

16473

THE PREPARATION OF POWDER SPECIMENS FROM ACTIVE AND TOXIC METALS FOR USE IN CONVENTIONAL X-RAY DIFFRACTION STUDIES. A. Moore, D. B. Wright, and A. J. Martin (Atomic Weapons Research Establishment, Aldermaston, Berks., Eng.). J. Sci. Instr. 35, 301-3(1958) Aug.

An argon dry box and an associated procedure is described for the preparation of specimens for use in Debye-Scherrer powder cameras at high and low temperatures. Special features allow filings to be annealed at >1200°C, and quenched, if necessary, in vacuo: there is no need for filings to be sealed in a container for this purpose. Filings can be sealed in silica quills (~0.025 in. OD and wall thickness ~0.005 in.) for use as specimen by a small electrical furnace. The dry box is designed to enable an operator to be fully protected and to have fine control over the specimen at all stages of its preparation. (auth)

16474

EFFECTS OF CRYSTALLINE IMPERFECTIONS ON THE DIFFRACTION OF X RAYS. A. Guinier (Conservatoire National des Arts et Metiérs, Paris). Nuovo cimento (10) 7, Suppl. No. 2, 444-79(1958). (In French)

The possibilities of x rays in the study of crystal structure and imperfections are discussed. The general theory of x ray diffraction is first covered. The structure of metallic solid solutions is discussed in the second part. In the third section the use of x rays for the study of pre-precipitation in supersaturated solid solution is described. (J.S.R.)

16475

LATTICE IMPERFECTIONS IN THIN LAYERS. R. Hilsch and W. Martienssen (Univ. of Gottingen, Germany). Nuovo cimento (10) 7, Suppl. No. 2, 480-97 (1958). (In German)

The production of disordered crystalline layers by vapor deposition at low temperatures was investigated. The crystalline layers were formed by evaporation of the substance in high vacuum and condensation on a support cooled to very low temperatures. The results of studies on x-ray and electron diffraction, optical absorption, electric conductivity and superconductivity, and fault formation energy are reported and discussed. (J.S.R.)

16476

A STUDY OF ETCHING STRUCTURE ON ALUMINIUM BY TRANSMISSION ELECTRON MICROSCOPY. R. Phillips and N. C. Welsh (Associated Electrical Industries Ltd., Aldermaston, Berks., Eng.). Phil. Mag. (8) 3, 801-5(1958) Aug.

Aluminum foils thinned by acid etching were examined by transmission electron microscopy. Cellular patterns, 0.2 μ in spacing, were observed superimposed upon the normal subgrain structure of the metal. The cellular structure resembles patterns observed by other workers on replicas of chemically polished aluminum and interpreted as evidence of crystal misorientation. This communication shows that the cellular structure arises from a surface etching process and bears no relation to the distribution of dislocations in the metal. It is therefore most improbable that a further subdivision of the crystals is revealed. (auth)

16477
AN ELECTRO-POLISHING TECHNIQUE FOR THE PREPARATION OF METAL SPECIMENS FOR TRANSMISSION ELECTRON MICROSCOPY. Heather M. Tomlinson (Cavendish Lab., Cambridge, Eng.). Phil. Mag. (8) 3, 867-71(1958) Aug.

The conditions are described under which thin metal specimens can be produced by electron-polishing for examination by transmission electron microscopy. The method was applied to Mg, Co, Cu, Ni, Al, α-brass, and Fe, and representative micrographs showing the arrangement and movement of the dislocations are presented. Some practical hints are given relating to the use of the transmission electron-microscope technique for the study of dislocations in metals. (auth)

16478
ELECTRON-NUCLEAR DOUBLE RESONANCE OF F CENTERS IN LITHIUM FLUORIDE. Norman W. Lord (Johns Hopkins Univ., Silver Spring, Md.). Phys. Rev. Letters 1, 170-1(1958) Sept. 1.

In LiF the spin resonance of the F-center electron is partially resolved by its hyperfine interactions with neighboring nuclei. Discrepancies between observed and theoretically predicted values of these interactions are most serious for the lighter alkali halides. This situation motivated a more detailed experimental investigation of the electronic structure of this center using the new double resonance technique. A crystal of LiF was heavily irradiated with 50-kv x rays thereby inducing a high concentration of F centers. (W.D.M.)

16479
THEORY OF COHESIVE ENERGY OF LiH CRYSTAL. THE METHOD OF SEMI-LOCALIZED CRYSTALLINE ORBITAL (SLCO). I. Akira Morita and Kenji Takahashi (Tohoku Univ., Sendai, Japan). Progr. Theoret. Phys. (Kyoto) 19, 257-68(1958) Mar.

The method of semi-localized crystalline orbital (SLCO) is presented to investigate the influence of homopolar binding on the cohesive energies of ionic crystals. Computations are performed for a LiH crystal. As a result, it is shown that the discrepancy between the theoretical value of the cohesive energy of LiH crystals, which was calculated by Lundqvist, and the observed one is removed by taking homopolar binding into account. The relation between the energy band structure and SLCO is discussed and it is shown that SLCO corresponds to Wannier's functions of the valence and conduction bands for the case of a LiH crystal where the valence and conduction bands are non-degenerate. (auth)

Electrical Discharge

16480 AERE-Inf/Bib-117
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
A LIST OF UNITED KINGDOM ATOMIC ENERGY RESEARCH ESTABLISHMENT UNCLASSIFIED MEMORANDA AND REPORTS ON CONTROLLED THERMONUCLEAR REACTIONS. C. S. Sabel, comp. June 1958. 7p. $0.32(BIS).

This list is arranged with the memoranda first in order of issuing division and in serial number order. The reports follow in serial number order irrespective of the issuing division. The United States Atomic Energy Commission report TID-3506 (Rev. 1) of September 1957 gives a list of U.S.A.E.C. unclassified reports on controlled thermonuclear reactions. The availability of United Kingdom Atomic Energy Authority unclassified reports is given. (auth)

16481 AEC-tr-3371
KINETIC THEORY OF MAGNETOHYDRODYNAMIC WAVES. B. N. Greshman. Translated for Princeton Univ. from Zhur. Eksptl'. i Teoret. Fiz. 24, 453-65 (1953). 16p.

The propagation of magnetohydrodynamic waves in an ionized gas in the direction of a constant magnetic field was investigated using kinetic equations. Expressions are obtained for the phase velocity of the waves and for the damping decrement of the oscillations taking into consideration the thermal motion of the particles in the gas. (auth)

16482 AEC-tr-3372
ON THEORY OF SPORADIC RADIATION OF THE SUN. V. V. Zhelezniakov. Translated for Princeton Univ., from Radiotekh. i Elektron. 1, 840-5(1956). 15p.

The process of transformation of the plasma waves into the electromagnetic waves in non homogeneous plane stratified medium is considered in connection with the problem of sporadic radiation of sun. The coefficient of transformation of plasma wave into electromagnetic wave defined as the square of the ratio of the amplitudes of the electromagnetic wave to the amplitude of plasma wave is of the order of 3×10^{-7} in the conditions of sun's corona. (auth)

16483 NP-tr-124
ON THE MOTION OF IONS AND THE SHAPE OF THEIR LINES IN THE POSITIVE DISCHARGE COLUMN. III. A DIRECTED MOTION OF IONS IN A DISCHARGE AT ARBITRARY PRESSURE. Yu M. Kagan and V. I. Perel. Translated by L. F. Bovey (U.K.A.E.A., Atomic Energy Research Establishment) from Optika i Spektroskopiya 4, 285-8(1958). 6p.

An expression is derived for the velocity of the directed motion of the ions in the positive column of a discharge at an arbitrary pressure. Taken into consideration are the longitudinal and transverse field, the volume ionization, and the flow of ions to the wall. (auth)

16484 SCL-T-48
ON AN EXPERIMENTAL AND THEORETICAL DETERMINATION OF THE THERMAL CONDUCTIVITY OF THE PLASMA IN A HIGH-CURRENT CARBON ARC. (Ube: eine experimentelle und theoretische Bestimmung der Warmeleitfahigkeit des Plasmas eines Hochstromkohlebogens.) R. Wienecke. Translated by M. I. Weinreich (Sandia Corp.) from Z. Physik 146, 39-58(1956). 24p.

The total thermal conductivity for the plasma of a high-current carbon arc is determined from the observation of the cooling trend in the arc column after a sudden circuit break of the arc current as a function of the temperature within a range from 4000° to 10,000°K, after which the total thermal conductivity is compared with the theoretically calculated values. The qualitative agreement between the experimental and theoretical absolute-values is satisfactory, whereas the curves (heat conductivity vs. temperature) show a displacement relative to each other, in such a way that the experimentally found curve is shifted toward temperatures which are lower than those of the theoretically ascertained curve. It is presumed that the cause of this phenomenon is to be sought in the existence of relaxation processes during the recombination of atoms into molecules. (auth)

16485 SCL-T-53

TEMPERATURE MEASUREMENTS IN WATER-STABILIZED HIGH-POWER ARCS. (Temperturmessungen am Wasserstabilisierten Hochleistungsbogen). F. Burhorn, H. Maecker, and Th. Peters. Translated by M. I. Weinreich for Sandia Corp. from Z. Physik 131, 28-40(1951). 25p.

Spectroscopic temperature measurements on a water-stabilized high-power arc between 100 and 1500 amp yield values up to 50,000°K. Similiar measurements, combined with theoretical considerations, makes it possible to plot the isotherm field in the diagram of characteristics for all water-stabilized high-power arcs. (auth)

16486

CONTROLLED NUCLEAR FUSION. L. Biermann. Atomwirtschaft 3, 343-4(1958) Aug.-Sept. (In German)

The work being done in the German Federal Republic on controlled nuclear fusion include high temperature physics, plasma physics, magnetohydrodynamics, and electric discharge. (J.S.R.)

16487

EVOLUTION OF DEUTERIUM–TRITIUM MIXTURES. Georges Boulègue, Paul Chanson, René Combe, Marc Feix, and Pierre Strasman. Compt. rend. 247, 284-6 (1958) July 21. (In French)

The evolution of a DT mixture formed initially at a temperature T_0 was studied. In particular the variation of the energy liberated was determined as a function of T_0 and the tritium concentration. For pure deuterium, the formation of tritium by the DD_n reaction limits the necessary temperatures to 28 kev. The addition of a small quantity of tritium reduces the temperatures considerably. (tr-auth)

16488

ENERGY LOSS OF CHARGED PARTICLES IN A PLASMA. Georges Boulègue, Paul Chanson, René Combe, Marc Feix, and Pierre Strasman. Compt. rend. 247, 445-8(1958) July 28. (In French)

The shocks between an incident particle and the constituents of a plasma are analyzed according to the laws of classical dynamics. The general expression for the energy loss (which is then particularized for the case of Coulomb interactions) and the expression for the equilibrium time were derived. Some numerical results are given for the case of lithium deuteride. (tr-auth)

16489

UNIDIMENSIONAL AUTOMODEL MOTIONS OF A CONDUCTING GAS IN A MAGNETIC FIELD. V. P. Korobeinikov (Steklov Inst. of Math., Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 121, 613-15 (1958) Aug. 1. (In Russian)

Studies were made of unidimensional non-stationary adiabatic motion of ideal electroconducting gas with cylindrical and flat waves. (R.V.J.)

16490

ON THE ION MOTION IN PLASMA. Yu. M. Kagan. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 702-7(1958) June. (In Russian)

The rate of ion drift, the distribution of ion energy, and the temperature in various gases are investigated. (R.V.J.)

16491

ON THE THEORY OF BROADENING SPECTRAL LINES IN PLASMA. V. I. Kogan (Moscow Inst. Engineering Physics). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 714-17(1958) June. (In Russian)

A review is given of the theory of spectral line broadening caused by the Stark effect, with considerations of disturbance by the electric field created by the assembly of large number of moving charged particles. In the proposed theory it is assumed that both ions and electrons can be classically described, that positions of charged particles are not mutually correlated (i.e., that their spatial distribution is taken at random at a given mean density), that their motion is rectilinear, that the perturbation field is uniform, and that the field has an adiabatic effect on the atom. (R.V.J.)

16492

ON THE BROADENING AND SHIFT OF SPECTRAL LINES IN HIGHLY IONIZED PLASMA. L. A. Vainshtein, V. G. Koloshnikov, et al (Lebedev Inst. of Physics, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 718-19(1958) June. (In Russian)

A detailed study is undertaken of the interactions of emitting atoms with charged particles and in particular the feasibility of the relation $\gamma = 11.4\ C_4^{2/5} v^{3/5} N$ (where C_4 is the constant of quadratic Stark effect, v is the velocity, and N is the density of perturbation particles). The spark discharge is investigated where the broadening and shift of lines, due to the high degree of ionization and temperature, can be considered the result of electron and ion interactions with charged particles. (R.V.J.)

16493

THE MAXIMUM DISTURBANCE GROWTH RATE FOR AN UNSTABLE PLASMA COLUMN. Shobu Kaneko (Univ. of Tokyo). J. Phys. Soc. Japan 13, 947-53(1958) Aug.

A dispersion relation for a self-pinched plasma column enclosed by a conducting wall is derived for the case of a model with both surface sheet current and uniform volume current. On the basis of this dispersion relation the maximum disturbance growth rate for the instability is calculated. Both the uniform volume current and longitudinal magnetic flux outside the plasma column decrease the stability and make the growth rate faster, the effect of the magnetic flux being larger. (auth)

16494

EFFECT OF THE DISCHARGE ON THE RESISTANCE OF A THIN CATHODE LAYER IN GEIGER-MUELLER TUBES. A. Eckardt and U. Heinecke (Friedrich-Schiller-Universität, Jena, Germany). Naturwissenschaften 45, 331-2(1958). (In German)

The efficiency of Geiger-Mueller tubes were measured under operating conditions (with the filling gas 90 Torr Ar and 10 Torr ethyl alcohol) and it was found that the value measured for the efficiency was always lower than that for the pure materials. To measure the effect of an adsorbed gas layer on the efficiency, a glass tube with thin copper cathodes, 1 μ thick, was prepared by evaporation of a copper-plated tungsten wire in high vacuum. The resistance decrease of the copper cathode as a function of time is graphed. Ar does not affect the resistance, but the resistance decreased sharply when the alcohol was added. (J.S.R.)

16495

THE CONTAINMENT OF PLASMA BY THE PINCH DISCHARGE. George Thomson (Corpus Christi Coll., Cambridge, Eng.). Phil. Mag. (8) 3, 886-96(1958) Aug.

When a strong current is flowing axially in a plasma, with cylindrical geometry, the charged particles of the plasma will be prevented from striking the cylindrical wall both by the self-magnetic field of the current and,

in the case of the positive ions, by the electric field due to the negative charge in the region of the current. Calculations are made of these effects, which are relevant to the loss of heat by conduction from a thermonuclear device of the ZETA type. It is shown that in order to reduce the loss of heat by conduction to a value less than the energy generated in the discharge by a thermonuclear reaction in deuterium, it is necessary either to have a magnetic field corresponding to a current of the order of a thousand million amps, or to have a substantial electric field, giving a radial potential difference between the axis and wall of the order of 250 to 500 kv, together with currents of a few million amps. Reasons are given for supposing that such an electric field would in fact be set up as a concommittant of the current and the reaction. (auth)

16496

BERYLLIUM-7 EXTREME HIGH-TEMPERATURE EXPERIMENT. Carl A. Accardo (U.S. Signal Research and Development Lab., Fort Monmouth, N. J.). Phys. Rev. Letters 1, 180-1(1958) Sept. 1.

The experiment is suggested as a possible method of high-temperature thermometry in the million-degree range and also to provide information regarding electron-nucleus interaction in K-capture processes. (W.D.M.)

16497

IONIC CANON OF 20 TO 30 KILOVOLTS. L. N. Bykovskaya. Pribory i Tekh. Ekspt. No. 2, 49-51(1958) Mar.-Apr. (In Russian)

The design and performance of a laboratory ion source for 20 to 30 kv are described. A high-voltage discharge acts as the ion source. Data are presented on the dependence of general discharge current and ion beam current on the applied tension for discharge chamber pressures between 0.18 and 0.25 mm mercury. (R.V.J.)

16498

A SOURCE OF NEGATIVE HYDROGEN IONS. Yu. M. Khirnyi. Pribory i Tekh. Ekspt. No. 2, 51-3(1958) Mar.-Apr. (In Russian)

Negative ions can be obtained during recharge of protons on hydrogen or deuterons and deuterium in the capillary of a high-frequency ion source. H^- currents of 20 μa and D^- currents of 15 μa were obtained. The inleakage of hydrogen with the 20 μa H^- current is 28 cm^3/hr. The source service life is about 200 hr. (tr-auth)

16499

PROPAGATION OF AN ELECTROMAGNETIC FIELD IN A MEDIUM WITH SPATIAL DISPERSION. V. D. Shafranov. Zhur. Eksptl'. i Teoret. Fiz. 34, 1475-89 (1958) June. (In Russian)

General formulas are obtained for an electromagnetic field in a semi-infinite homogeneous anisotropic medium with spatial dispersion. Propagation of a transverse wave along a magnetic field in a plasma is investigated with account of thermal motion of the electrons. It is pointed out that absorption of the electromagnetic field is strong in the region in which Čerenkov radiation occurs in the plasma. (tr-auth)

16500

ENERGY DIFFUSION OF FAST IONS IN AN EQUILIBRIUM PLASMA. V. S. Kudryavtsev (Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 1558-65(1958) June. (In Russian)

Energy diffusion of fast ions injected into an equilibrium plasma is considered. The energy distribution of the injected ions is initially monochromatic, the corresponding energy exceeding the mean thermal energy in the plasma. It is assumed in this case that the distribution of the velocity directions is isotropic. The law of approach of the distribution to the Maxwellian is derived. The result can be obtained with help of the superposition principle for arbitrary initial distribution, since the equations are linear. (tr-auth)

16501

ENERGY SPECTRUM OF A HIGH DENSITY ELECTRON GAS. Chen Chun-Syan and Chow Si-Hsun (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 34, 1566-73(1958) June. (In Russian)

A special class of diagrams corresponding to the diverging terms in the usual perturbation theory expansion for a system with coulomb interaction (infrared divergence) is summed by the second quantization procedure. An energy spectrum for a high density electron gas is derived which contains individual excitation (quasi-particles obeying Fermi statistics) as well as collective excitations of the plasma type. The correction to the heat capacity due to appearance of self energy of the elementary excitations is computed. The results are compared with those of Gell-Mann and Brueckner. To a certain extent the results can be considered as a justification of the independent particle model in the electron theory of metals. (tr-auth)

16502

INCLINED SHOCK WAVES IN A PLASMA WITH FINITE CONDUCTIVITY. M. I. Kiselev and V. I. Tseplyaev (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 34, 1605-9(1958) June. (In Russian)

The structure of the front of a shock wave in a plasma with finite conductivity is considered by neglecting its viscosity and thermal conductivity. The conditions of applicability of the approximation are derived. An estimation is made of the width of the wave front. The limiting angle of propagation of an inclined shock wave in a plasma with infinite conductivity is determined. (tr-auth)

Electrons

16503

MAGNETIC DEFLEXION OF ELECTRON BEAMS WITHOUT ASTIGMATISM. G. D. Archard and T. Mulvey (Associated Electrical Industries Ltd., Aldermaston, Berks., Eng.). J. Sci. Instr. 35, 279-83(1958) Sept.

An electron beam passing through a magnetic deflecting field is, in general, subject to astigmatism. For circular pole pieces, this takes the form of focusing in the plane of deflection; for square pole pieces, focusing perpendicular to the plane of deflection. Deflection free from astigmatism can be achieved by means of circular pole-pieces from which semicircular portions have been removed. An application of this to reflection electron microscopy is described. (auth)

16504

RELATION BETWEEN NUCLEAR RECOIL AND TRANSVERSE POLARIZATION OF β PARTICLES. Géza Györgyi and Herbert Überall (Dept. of Atomic Physics, Hungarian Academy of Sciences). Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közlemenyei 5, 572-6(1957) Nov.-Dec. (In Hungarian)

The β-decay probability is calculated for given neutrino momentum, electron polarization, and momentum using the general parity-nonconserving hamiltonian of Lee and Yang. For fixed neutrino momentum the transverse polarization of β particles does not vanish. A

possible experiment to detect this polarization is discussed. (auth)

16505

SURVEY OF THE EXPERIMENTAL SITUATION IN β-DECAY. M. A. Grace (Univ. of Oxford). Proc. Roy. Soc. (London) A246, 454-62(1958) Aug. 26.

The experimental results which have come from "classical" and "parity" experiments are summarized. The results fall into the following broad categories according to the type of information obtained: ft-values, Fierz terms, electron polarization experiments, nuclear polarization and β-γ circular polarization correlations, and neutrino recoil experiments. (W.D.M.)

16506

THE MEASUREMENT OF ELECTRON-NEUTRINO ANGULAR CORRELATIONS. B. W. Ridley (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Proc. Roy. Soc. (London) A246, 471-81(1958) Aug. 26.

Some of the difficulties encountered in experimental work on electron-neutrino angular correlations are described and illustrated with a description of the experiment on Ne^{23}. There are three observables one can use to find the electron-neutrino correlation: the electron energy, the recoil momentum, and the angle between the electron and recoil rays. (W.D.M.)

16507

ON THE INFLUENCE OF QUANTUM FLUCTUATIONS ON ELECTRON MOTION. V. S. Tumanov. Vestnik Moskov. Univ. 12, No. 5, 105-10(1957). (In Russian)

An attempt was made to show that the quantum characteristics of electron motion are related to the quantum characteristics of the field and that zero energy, the idefiniteness ratio, and adjustable ratios are the result of quantum fluctuations of electromagnetic vacuum. (R.V.J.)

16508

ON THE BEHAVIOR OF THE DISTRIBUTION FUNCTION OF A MANY-PARTICLE SYSTEM NEAR THE FERMI SURFACE. D. A. Kirzhnits (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret Fiz. 34, 1625-8(1958) June. (In Russian)

The form of the distribution function of a system of electrons near the Fermi surface is investigated in the Hartree approximation for a weak inhomogeneous distribution. It is shown that in this region the role of inhomogeneities becomes very significant and consequently the correct expression for the distribution function presented differs greatly in this region from the expression usually applied (computed on basis of the Thomas–Fermi model). It is noted that the latter is totally invalid in those problems in which the vicinity of the Fermi boundary plays an important role. (tr-auth)

16509

ON THE SYMMETRY OF MULTI-ELECTRON SCHROEDINGER WAVE FUNCTION. E. D. Trifonov (Leningrad State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 34, 1643-4(1958) June. (In Russian)

The Schroedinger equation for multi-electron systems was studied with the assumption that the hamiltonian in the equation does not contain spin operators. Due to equivalence of electrons the hamiltonian remains invariant in relation to the symmetric group transpositions of electron spatial coördinates. Then according to the Wigner theorem, the eigenfunction related to each intrinsic energy magnitude should form the basis of one of the irreducible symmetric group representations. (R.V.J.)

Gases

16510 P-582(RAND)

RAND Corp., Santa Monica, Calif.

THE BLAST FROM A SPHERE OF HIGH PRESSURE GAS. H. L. Brode. Jan. 27, 1955. 19p.

Presented at the American Physical Society Meeting, Jan. 27-29, 1955.

The gas dynamics resulting from the release of an isothermal sphere of gas initially at rest and at a high pressure are described by the numerical solution of the differential equations which represent an ideal gas in radial motion. The resulting outward shock and the inward rarefactions and shocks are described in some detail and are compared with the gas dynamics of the point-source solution. This phenomenon is observed in the present calculations to occur repeatedly, subjecting the origin to several compressive waves which are reflected there and which move out to overtake the main shock. (auth)

16511

SPECTROSCOPIC STUDIES OF GAS CONDITIONS BEHIND A SHOCK WAVE. N. N. Sobolev, A. V. Potapov, et al (Lebedev Inst. of Physics, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 730-6 (1958) June. (In Russian)

Descriptions are given of the impact tube method developed for measuring the air temperature behind a shock wave. (R.V.J.)

16512

THERMAL CONDUCTIVITY OF THE SOLIDIFIED INERT GASES: ARGON, NEON AND KRYPTON. G. K. White and S. B. Woods (National Research Council, Ottawa). Phil. Mag. (8) 3, 785-97(1958) Aug.

The thermal conductivity of the solidified inert gases Ar, Ne, and Kr, contained in an Inconel tube, was measured at temperatures from 2°K to near their melting points. Above about 15°K, the thermal conductivity, λ, may be represented by the expression $\lambda \simeq B/T$, where B has values of 250 mw cm^{-1} for Ar, 75 for Ne, and 270 for Kr. Values calculated from approximate theoretical treatments of lattice anharmonicity yield values in excess of these by about 30 to 80%. At liquid helium temperatures, i.e., below the conductivity maximum, λ varies approximately as T^2 and is small in magnitude, suggesting mean free paths of 10^{-5} to 10^{-4} cm for the lattice waves. This may result from the large contraction of the solids during cooling which produces severe internal strains and probably results in many lattice defects within the crystals. (auth)

16513

THERMAL DIFFUSION IN IONIZED GASES. Sydney Chapman (Univ. of Alaska and High Altitude Observatory, Boulder, Colo.). Proc. Phys. Soc. (London) 72, 353-62 (1958) Sept.

Thermal diffusion in mixed gases depends on a thermal diffusion factor α, which is less than unity in all known neutral gas mixtures (in which the particles have no electric charge). In simple ionized gases α exceeds unity, being of order Z + 1, where Ze is the charge on the ions. However, in the steady state of such a gas, at non-uniform temperature, thermal diffusion does not produce a concentration gradient of the electrons relative to the ions; instead it sets up an electric field, which keeps the gas electrically neutral almost everywhere. In an ionized atmosphere subject to gravity, in which the temperature increases upwards, this electric field opposes and reduces the electric field that keeps the electrons and ions together,

despite the great difference between their masses. The thermal diffusion factor seems to be greatest for the ions of different kinds in a mixed ionized gas, composed mainly of electrons and light ions of small charge Ze, with a small admixture of heavy ions of greater charge Z'e. In this case α is of order 2.5 $(Z'/Z)^2$, and can amount to several hundred. In such a gas, at non-uniform temperature, thermal diffusion can much increase the (still small) proportion of the heavy multiple ions in the hotter regions. The electric field that keeps the electrons with the ions, so that the gas is neutral, reinforces this tendency of the multiple ions, in the cases here considered. This tendency may have some importance in the solar corona, if turbulence is not too great and temperature inequalities persist long enough. It seems likely also that thermal diffusion will influence the distribution of the multiple ions present in the ZETA nuclear fusion apparatus. (auth)

16514

THE EXPERIMENTAL DETERMINATION OF THE PRIMARY IONIZATION COEFFICIENTS AT LOW GAS PRESSURES. Eifionydd Jones and F. Llewellyn Jones (University Coll. of Swansea). Proc. Phys. Soc. (London) 72, 363-8(1958) Sept.

An assessment of the method used to measure values of the Townsend primary coefficient of ionization at low pressures is given. This shows that the secondary processes of ionization must, in general, be taken into consideration in the analysis of the data, especially at pressures of the order of a few millimeters of mercury, in order to obtain accurate values of α/p_0. (auth)

16515

THE IONIZATION PRODUCED BY BEAMS OF CARBON AND NITROGEN IONS. W. E. Burcham and M. A. F. Alves (Univ. of Birmingham, Eng. and Univ. of Coimbra, Portugal). Proc. Phys. Soc. (London) 72, 462-6(1958) Sept.

The calculated ionization produced by carbon ions is compared with that observed for both carbon and nitrogen ions of energies up to about 80 Mev passing through argon. (L.T.W.)

Instruments

Refer also to abstract 16334.

16516 HW-54682

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PRPR OPTICAL PROFILOMETER. Byron B. Brenden. Jan. 15, 1958. 17p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

The optical profilometer is intended to give information about the warp and diameter of PRPR concentric cylinder fuel elements. Warp and diameter measurements can be made with an accuracy of ±0.001 inch using a visual system coupled with photography. (W.D.M.)

16517 SCTM-189-55(52)

Sandia Corp., Albuquerque, N. Mex.

WARRICK TIME LINE GENERATOR. V. W. Hansen. Aug. 31, 1955. 12p. Contract [AT(29-1)-789]. $3.30 (ph OTS); $2.40(mf OTS).

The Warrick Time Line Generator was designed to minimize timing errors due to parallax and phase displacement of timing pips on Warrick Camera records. With the new system, timing lines are generated by deflection of the beam of the 513-D Oscilloscope. (auth)

16518 UCRL-3453

California. Univ., Berkeley. Radiation Lab.

OCCLUDED-GAS ION SOURCE. Kenneth W. Ehlers. June 27, 1956. 14p. Contract W-7405-eng-48. $3.30 (ph OTS); $2.40(mf OTS).

Characteristics of a pulsed, occluded ion source, operating in a magnetic field, were investigated. Mass spectra of hydrogen- and deuterium-loaded sources are presented. Constructional details of the source and its operating characteristics are discussed. (auth)

16519 SCL-T-197

ON THE RADIATION INERTIA OF AEROLOGICAL THERMOMETERS. (O Radiatsionnoy Inertsii Aerologicheskikh Termometrov). L. G. Kachurin. Translated by Marcel I. Weinreich (Sandia Corp.) from Meteorologi. i Gidrologi. No. 8, 57-60(1957). 9p.

A study of the errors in aerological thermometers due to radiative heating and inertia is presented. A solution is given in which the radiational heat exchange of the thermometer with its environment is characterized by the radiational balance of the thermometer's surface. Such a solution makes it possible to single out graphically the radiative overheating as well as the radiative and kinetic inertia for various cases, thus evaluating their reciprocal values. (T.R.H.)

16520

THERMISTORS FOR TIME LAG AUXILIARY RELAYS. F. Gustafsson. ASEA Journal 31, 13-15(1958).

The thermistor constitutes a simple and inexpensive means of delaying the pick-up of an auxiliary relay in those cases which do not call for great accuracy or for independence of variations in voltage and temperature. It requires little space, it can often be mounted directly on the relay terminal, it is suitable for use with both alternating and direct current, and it is easily fitted to relays which are already in use. (auth)

16521

A NEW SUPPLY-VOLTAGE REGULATOR OF TRANSDUCTOR TYPE. M. Johansson. ASEA Journal 31, 37-40(1958).

A new type of supply-voltage regulator is presented, which is of transductor type, but its circuitry is different from that of the older model. The mode of operation and the properties of the new regulator type. YTNB are described. (auth)

16522

A NOMOGRAPH FOR MIXED RADIATIONS DOSIMETRY. G. M. Obaturov. Atomnaya Energ. 4, 585-6(1958) June. (In Russian)

A design is presented of a nomograph for simultaneous calculation of permissible doses of mixed radiation emitted by gases and aerosols along with equipment and working clothes. (R.V.J.)

16523

AN APPARATUS FOR THE VISCOMETRY OF ORGANIC LIQUIDS AT HIGH TEMPERATURE. W. G. Burns, B. Morris, and R. W. Wilkinson (Atomic Energy Research Establishment, Harwell, Berks., Eng.). J. Sci. Instr. 35, 291-3(1958) Aug.

An apparatus suitable for the measurement of the viscosity of organic liquids at temperatures of up to 400°C is described. A sealed glass capillary viscometer is used so that oxygen can be excluded and measurements made above the normal boiling point. The viscometer is immersed in a molten salt mixture contained in a welded tank and is viewed through special windows. These consist of Kodial polished glass disks

sealed to Kovar cylinders. A rotation arrangement enables the viscometer to be inverted. Examples are given of its uses on known materials and on the effect of irradiation of para-terphenyl. (auth)

16524

THE USE OF A MANOMETRIC DENSITOMETER FOR MOLTEN SALTS. L. J. B. Husband (Imperial Coll. of Science and Tech., London). J. Sci. Instr. 35, 300-1 (1958) Aug.

A manometric method of determining the density of a liquid is described. After calibration of the densitometer only remote observations need be made of a setting to a fiducial line and of the pressure of an applied gas. No confining fluid is used. This makes the densitometer particularly suitable for liquids at high temperatures. The densities of the following inorganic salts above their melting points have been found: sodium nitrite, potassium thiocyanate, and potassium chlorate. (auth)

16525

A SIMPLE SINGLE CHANNEL DIFFERENTIAL DISCRIMINATOR. Ákos Albert (Dept. of Physics for Experimental Reactors, Hungarian Academy of Sciences). Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közlemenyei 5, 599-607(1957) Nov.-Dec. (In Hungarian)

A very simple, accurate, and stable single channel differential discriminator is described. The artificial delay before the anticoincidence stage and the input amplifier, which are well known problems in the usual arrangements, are eliminated. Dead time is only 5 to 10 μsec; the maximum error in discrimination is 0.1. (auth)

16526

REDUCTION OF THE CLOSING TIME OF OVERCONTROLLED PULSE AMPLIFIERS. Antal Csákány (Dept. of Physics for Experimental Reactors, Hungarian Academy of Sciences). Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közlemenyei 5, 608-12(1957) Nov.-Dec. (In Hungarian)

Low pulses have to be amplified linearly in the presence of high amplitude pulses in gamma spectroscopy. An amplification system meeting this requirement satisfactorily is described. (auth)

16527

APPARATUS FOR MEASURING MICROSECOND TIME INTERVALS. B. A. Predein. Pribory i Tekh. Ekspt. No. 2, 31-6(1958) Mar.-Apr. (In Russian)

The design is given of an apparatus for measuring time intervals of 5 to 265 μsec with an accuracy of ± 0.1 μsec. The apparatus uses two methods of direct time reading: the generator method and the linear measurement method. (tr-auth)

16528

USE OF ELECTRON-BEAM TUBE IN STABILIZATION OF MAGNETIC FIELDS. V. V. Zhukov and N. N. Semashko. Pribory i Tekh. Ekspt. No. 2, 41-4(1958) Mar.-Apr. (In Russian)

Descriptions are given of magnetic field stabilization with electron-beam tubes used as sensitive zero indicators. The accuracy margin of the stabilization is 0.005% with 20% variations in the feeding tension and permissible fine field control within 30% limits of maximum value. (tr-auth)

16529

METHOD FOR ION SOURCE OPERATION CONTROL. G. M. Osetinskii (Joint Inst. of Nuclear Research). Pribory i Tekh. Ekspt. No. 2, 101-3(1958) Mar.-Apr. (In Russian)

Data are presented on high-frequency ion source control by variations in the transverse magnetic field intensity. The method secures a rapid tuning of the source to the necessary operating level. (tr-auth)

16530

INSTALLATION FOR DETERMINING THE OPTIMUM PERFORMANCE OF PHOTOMULTIPLIERS. A. N. Svenson (Inst. of Machine Building and Automatics, Academy of Sciences, Ukrainian SSR). Pribory i Tekh. Ekspt. No. 2, 103-4(1958) Mar.-Apr. (In Russian)

16531

SYNCHRONIZED AUTODYNE DETECTOR IN STUDIES OF NUCLEAR MAGNETIC RESONANCE SPECTRA. Yu. S. Konstantinov (Moscow State Univ.). Pribory i Tekh. Ekspt. No. 2, 105(1958) Mar.-Apr. (In Russian)

Nuclear magnetic resonance of F^{19} in perfluorobutylene (C_4F_8) was studied with synchronized and nonsynchronized autodyne detectors. (R.V.J.)

16532

INDUCTION FLOWMETER. Vincent Cushing (Armour Research Foundation, Chicago). Rev. Sci. Instr. 29, 692-7(1958) Aug.

According to Faraday's law of induction an electric field will be induced in a medium moving relative to a magnetic field. This induced electric field is proportional to the intensity of the magnetic field and to the relative velocity of the moving medium. When applied to media of arbitrary electrical conductivity and dielectric constant, it is seen that any potential difference that arises in connection with the induced electric field is attenuated by the shunting effect of the permittivity of free space. For most media this shunting effect is negligible; for media of extremely low conductivity, however, the effect is appreciable. Finally the effect of the electrical properties of the containing pipe is investigated. (auth)

16533

PRECISION MICROSCOPE FOR LARGE NUCLEAR PLATES. Ivar Kalberg, D. M. Haskin, and Marcel Schein (Univ. of Chicago) and G. T. Zorn (Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr. 29, 697-8 (1958) Aug.

A microscope, with coordinate motions of 21 × 15 cm which may be used in the analysis of large nuclear plates is described with particular attention given to constructional details. The design includes a magnetic clutch for fixing plate position, a rotating super-stage and dial indicators to observe both horizontal and vertical movement. A stage noise $\overline{D}_{noise} \leq 0.029\ \mu$ for cell lengths up to 1 mm was obtained. (auth)

16534

USE OF CONSTANT CURRENT HOT WIRE FOR THE MEASUREMENT OF EXTREME TEMPERATURES. Stuart A. Hoenig (Univ. of California, Berkeley). Rev. Sci. Instr. 29, 704-5(1958) Aug.

The theory of the constant-current hot-wire circuit for measurement of very high gas temperatures is developed and it is shown that such a system may be used above the melting point of the wire itself. (auth)

16535

MANOSTAT FOR HIGH-PRESSURE OPERATIONS. H. H. Reamer and B. H. Sage (California Inst. of Tech., Pasadena). Rev. Sci. Instr. 29, 709-12(1958) Aug.

The maintenance of isobaric conditions at pressures of the order of 10,000 lb/in.^{2} is sometimes a difficult

operation in transport studies. A manostat has been devised which will maintain isobaric conditions with a precision of about 1 part in 100,000 at pressures from 500 to 10,000 lb/in.^{2}. The equipment functions satisfactorily as a pressure transducer for control purposes. (auth)

16536

RESISTANCE THERMOMETER BRIDGE FOR MEASUREMENT OF TEMPERATURES IN THE LIQUID HELIUM RANGE. C. Blake, C. E. Chase, and E. Maxwell (Massachusetts Inst. of Tech., Lexington). Rev. Sci. Instr. 29, 715-16(1958) Aug.

A 33-cps resistance thermometer bridge, suitable for precise temperature measurements in the liquid helium range, has been designed as a completely self-contained unit. The amplifier has a gain of 120 db, band width of 0.3 cps, and input impedance of 10 kohms. With a power dissipation of 2×10^{-8} watts in the thermometer, resistance changes of 0.1 ohm can be detected. For a typical resistance thermometer this corresponds to a temperature change of 4×10^{-6}°K at 2°K. Other features include high rejection of line-frequency pickup, short recovery time after saturation, and a combination gain bandwidth control which shortens the response time during preliminary balancing operations. (auth)

16537

DOUBLE REFLECTION X-RAY CAMERA. B. S. Fraenkel (Hebrew Univ., Jerusalem). Rev. Sci. Instr. 29, 726-7(1958) Aug.

An improved double reflection x-ray camera is described in which both the crystal and the film rotate simultaneously. It registers x-ray reflections from crystals in form of a line, and shows the double reflections on this line. Some examples of double reflections taken with this apparatus are shown. (auth)

16538

PRINTING REGISTER. P. W. Ford (Univ. of Tasmania, Australia). Rev. Sci. Instr. 29, 728-9(1958) Aug.

A device is described which records and prints data which can be represented by the decimal system of numbers. The register section can be arranged to handle several groups of figures containing any number of digits and has a total capacity of 16 digits. The registers automatically return to zero before the beginning of each recording period. (auth)

16539

TEMPERATURE CONTROL FOR HELIUM II. H. Forstat and John R. Novak (Michigan State Univ., East Lansing). Rev. Sci. Instr. 29, 733-4(1958) Aug.

A method is described for temperature control in which a carbon resistance thermometer in a bridge circuit is used as the sensing element. The detecting system is sensitive with ease in operation. (A.C.)

16540

DEVICE FOR THE AUTOMATIC DESCRIPTION OF SCATTERING MEASUREMENTS IN NUCLEAR EMULSIONS. Massimiliano Ferro-Luzzi and Mario Muchnik (Univ. of Rome and Istituto Nazionale di Fisica Nucleare, Rome). Ricerca sci. 28, 1451-6(1958) July. (In Italian)

A device for the automatic arithmetical manipulation of scattering measurements in nuclear emulsions is described. The apparatus consists of an electrical computing machine capable of taking the readings and of automatically computing the second differences while the measurement process goes on. The time for a given scattering measurement is reduced by a factor 3. (auth)

16541

A DEVICE FOR TAKING X-RAY PICTURES AT HIGH TEMPERATURES. Ye. I. Gindin and V. G. Prokhvatilov. Zavodskaya Lab. 24, No. 1, 106-7(1958).

A device to be attached to the camera intended for taking pictures of pulverized polycrystalline substances at high temperatures (up to 1500°) is suggested. The powder of the substance to be investigated is applied on to a platinum wire of about 0.2 mm diameter. The temperature is maintained by allowing the current to pass through this wire. The device consists of two suitably shaped brass plates, which are connected by a shaft. Between these plates a platinum wire is drawn in such a manner that one of its ends is made fast and the other is connected to a movable rod with a spring. This rod rests in two bearings of insulation material. The current is fed by 2 elastic lines in such a manner that one of them is connected to the connecting shaft of the device and the other to the free end of the movable rod. For reasons of safety this line is caught by an insulator which is fastened to one of the brass plates. The device is placed upon a steel rod in such a manner that the axis of this rod and that of the platinum wire is the same. The rod serves as a holder for the device with the sample and is fastened in the x-ray camera. Because of the automatic control of the current necessary a current stabilizer, an autotransformer, and a step-down transformer are provided (220/10). A small motor is connected here in order that the sample turns backwards and forwards but not in a complete revolution. Temperature is measured according to the linear modulus of extension of the platinum wire. (TCO)

16542

A SIMPLE DEVICE FOR TAKING X-RAY PICTURES OF MONOCRYSTALS AT HIGH TEMPERATURES. Yu. P. Simanov, V. S. Burov, and K. N. Semenenko. Zavodskaya Lab. 24, No. 1, 107(1958).

A new device to be used with the x-ray camera is described. The device consists of a round copper block with an opening passing through its center, into which a thermocouple is fitted. This block rests upon a second asbestos block which serves as a current and heat insulator. The device is placed firmly upon the goniometer head of the camera. The ends of the thermocouple are connected to the galvanometer "M-82". On the copper block an annular Nichrome heater is fastened which is connected with the mains by means of a step-down transformer. The sample (monocrystal) is pasted immediately on to the soldering seams of the thermocouple by means of a special adhesive somewhat above the openings of the copper block. The monocrystal of $Be_4O(GH_3GOO)_6$ was investigated at temperatures of 20, 50, 80, and 120° as an example of the operation of the device. The crystallization transformation was easily determined by means of x-ray pictures. (TCO)

16543

AN APPARATUS FOR THE PHOTOGRAPHING OF AN EVOLUTE SURFACE OF CYLINDRICAL METAL BODIES FOR THE PURPOSE OF CARRYING OUT CORROSION TESTS. S. N. Alekseyev. Zavodskaya Lab. 24, No. 1, 108-9(1958).

The principle of the apparatus described consists in taking a photographic picture of the surface of a cylindrical body through a narrow slit which corresponds to the length of the axis of this body; by causing the cylindrical body to revolve around its axis in front of the film camera a film is obtained that represents the unrolled surface of the cylindrical body. The same effect can be obtained if the film camera moves synchronically

around the cylindrical body, but the first-mentioned order is technically more easily attained. The apparatus is sketched. (TCO)

Isotopes

16544

ISOTOPIC EXCHANGE REACTIONS BETWEEN SELENIUM CYANIDES AND CYANIDES. II. EXCHANGE IN AQUEOUS SOLUTIONS. Umberto Belluco, Maria Bruno and Gaetano Schiavon (Univ. of Padua). Ricerca sci. 28, 963-6(1958) May. (In Italian)

Following previous investigations the isotope exchange reaction in an aqueous solution between KSeCN and KGN marked with C^{14} was studied. The authors determined the activation energy values, of the order with respect to each reactant and a marked influence of the ionic force on the velocity of the process was ascertained. (auth)

16545

THE ISOTOPIC EXCHANGE BETWEEN Fe^{3+} IONS AND OXALATE COMPLEXES. Umberto Belluco, Maria Bruno, and Loris Busulini (Univ. of Padua). Ricerca sci. 28, 1166-7(1958) June. (In Italian)

Tests were conducted on the exchange between free ferric ion and oxalate complex in an aqueous solution at 0°C and with a minimum contact duration of 1 min, finding a total exchange with all the methods of separation used. This result is in agreement with the views on the bonds occurring in this oxalic complex. (auth)

Isotope Separation

16546

ISOTOPE SEPARATION. A. Klemm. Atomwirtschaft 3, 341-2(1958) Aug.-Sept. (In German)

Processes developed in the German Federal Republic for the separation of isotopes are described. These include distillation of liquid hydrogen and dual-temperature exchange for the production of heavy water, gas centrifugation and separation nozzle for uranium enrichment, and other methods for the enrichment of magnesium, lithium, and C^{14}. (J.S.R.)

16547

THEORY OF CHROMATOGRAPHY. PART II. ENRICHMENT OF ISOTOPES BY CHROMATOGRAPHY. E. Glueckauf (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Trans. Faraday Soc. 54, 1203-5(1958) Aug.

It is shown that the isotope separation data obtained by elution chromatography can be represented by a linear plot of the log of the local separation coefficient as ordinate against the fraction of the eluted mixture on a probability scale abscissa. The gradient of this plot has the value $\delta\sqrt{N}$, where N is the number of theoretical plates in the column (obtainable from the shape of the elution curve) and δ is the separation factor minus one. This technique of evaluation has been applied to the Na^{24}–Na^{22} separations by Betts, Harris, and Stevenson. It gives values of δ of 1.78×10^{-4}, 1.38×10^{-4}, and $\sim 0.7 \times 10^{-4}$ at 5, 25, and 55°C, respectively, indicating a heat of isotopic exchange of 0.4 cal/mole. (auth)

Mass Spectrography

16548

THE THERMAL-EMISSION ION SOURCE IN SOLID SOURCE MASS SPECTROMETRY. G. H. Palmer (Atomic Energy Research Establishment, Harwell, Berks., Eng.). J. Nuclear Energy 7, 1-12(1958) Aug.

The use of a thermal-emission ion source in a mass spectrometer is discussed in the light of the fractionation errors, and the difficulties of background spectra, when using high-sensitivity electron multiplier ion detectors. New techniques are described for the analysis of lithium, boron, cadmium, and tungsten which overcome some of the difficulties normally encountered, and the advantages of solids techniques are illustrated by considering the analysis of sub-microgram quantities of lead, uranium, and plutonium. (auth)

16549

A MASS SPECTROMETER MASS MARKER. J. H. Beynon and S. Clough (Imperial Chemical Industries, Manchester, Eng.). J. Sci. Instr. 35, 289-91(1958) Aug.

An instrument has been constructed which utilizes the galvano-magnetic effect in bismuth to measure the field strength of a mass spectrometer magnet, and hence to determine the masses of peaks as they occur when the spectrum is scanned by variation of the magnetic field strength at constant accelerating voltage. The bismuth coil is mounted between the pole-pieces of the magnet and the instrument marks on the mass spectrum a series of fifty mass calibration points at predetermined values of bismuth resistance and hence of magnetic field. Masses can be determined with the instrument to ± 0.05 mass unit in the range up to mass 200 and to an accuracy of $\pm 0.025\%$ above this range. (auth)

16550

USE OF ELECTRON MULTIPLIER IN ORDER TO IMPROVE THE MASS SPECTROMETER SENSITIVITY. M. G. Andreeva. (Scientific Research Inst. of Nuclear Physics, Moscow). Pribory i Tekh. Ekspt. No. 2, 53-6(1958) Mar.-Apr. (In Russian)

An electron multiplier was used as an ion counter, and commercial apparatus was used as a pulse recorder in experiments designed to investigate methods for improving mass spectrometer sensitivity. The experiments are described, and experimental and calculated results are compared. (D.E.B.)

16551

SCREENS FOR RADIO-FREQUENCY MASS SPECTROMETER. V. G. Istomin (Inst. of Applied Geophysics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 2, 111(1958) Mar.-Apr. (In Russian)

Models of 7 to 5 cycle mass spectrometer tubes with single-row screens were constructed. Tests showed that single-row screens not only do not reduce the mass spectrometer resolving power but somewhat improve it. (R.V.J.)

Mathematics

Refer also to abstract 16335.

16552 DP-299

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

IBM 650 ROUTINE III. SOLUTION OF SIMULTANEOUS DIFFERENTIAL EQUATIONS. Richard R. Haefner. July 1958. 24p. Contract AT(07-2)-1. $0.75(OTS).

A program was written for the IBM 650 to solve a set of N simultaneous, linear differential equations, where $N \leq 30$. The routine requires index registers and automatic floating decimal arithmetic. Either a Simp-

son method of fourth order, devised by Runge-Kutta, or the stable fifth-order method of Milne is available to advance the solution. The speed of the routine depends upon the number of zero elements in the matrix of coefficients and upon the special coding required when some matrix coefficients are not constant. Typical times to advance one interval in the Milne integration are 3.9 sec for N = 7, 9.5 sec for N = 14, and 14 sec for N = 18, where the number of nonvanishing matrix elements is of the order 2N in all cases. The Runge-Kutta method is about 1.5 times slower than the Milne method. (auth)

16553 DTMB-1166

David W. Taylor Model Basin. Applied Mathematics Lab., Carderock, Md.

704 PERTURBATION CALCULATION—AML PROBLEM 840-121. Maxine Jackson. Jan. 1958. 14p.

The three-group 704 perturbation calculation is a code to be used in connection with CURE for two-dimensional reactor design calculations. This code is designed to compute from given cross-section changes partial reactivity summations in specified regions. It allows 40 sets of cross-section changes and 199 regions for summation. Only one basic specification for the general layout of regions is allowed, but several sets of cross-section changes are permitted as input for a single run. (W.D.M.)

16554 NDA-43-3

Nuclear Development Corp. of America, White Plains, N. Y.

THE NUMERICAL INTEGRATION OF THE BOLTZMANN EQUATION. Status Report. J. Certaine and F. B. Chafets. Sept. 30, 1956. 66p. Project NIOBE. For Convair. Contract AF-33(038)-2117, Subcontract 280451 D.

The activities concerned with the analysis and coding of the numerical integration of the Boltzmann equation for the IBM-701 are separated into two main parts. The first part, coding of methods for the treatment of the energy degradation of neutrons upon scattering by light, medium, or heavy elements, was completed. The second part, numerical integration of the partial differential equation which results after all integrals in the Boltzmann equation have been reduced to sums, was originally to be effected by S_n method. It was decided that a better starting point for the numerical calculations would be the difference form of the equation. The details of this method are presented. (W.D.M.)

16555 WAPD-A1W-P(ND)-31

Westinghouse Electric Corp. Bettis [Plant], Pittsburgh.

CORRECTION OF COUNTING RATES FOR THERMAL FLUX SPECTRUM. Robert S. Wick. Aug. 16, 1956. 4p. $1.80(ph OTS); $1.80(mf OTS).

An approximate relationship is given for taking into account the effect of the thermal flux spectrum on experimentally determined counting rates obtained with Mn wires. The expressions are written in terms of DONATE thermal spectrum calculations. (auth)

16556 WAPD-TM-118

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

ON THE EQUIVALENCE OF THE SPHERICAL HARMONICS METHOD AND THE DISCRETE ORDINATE METHOD USING GAUSS QUADRATURE FOR THE BOLTZMANN EQUATION. Robert Gast. Apr. 1958. 19p. Contract AT-11-1-GEN-14. $0.75(OTS).

The relationship of the spherical harmonics method and the discrete ordinate method using Gauss quadrature is explicitly demonstrated. It is found that, in general, the two methods are not equivalent, but that they are upon a suitable modification of the source and scattering kernel used in the discrete ordinate method. This modification consists of expanding the source and kernel in spherical harmonics and truncating at the appropriate term. Analogous results are obtained for the double spherical harmonics and double Gauss quadrature methods. (auth)

16557 WAPD-TM-133

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

F0010—A TWO-DIMENSIONAL IBM-704 CODE FOR THE CALCULATION OF THERMAL STRESSES IN A LONG, HOLLOW CYLINDER WITH INTERNAL HEAT GENERATION. K. W. Brand, H. Kraus, and T. J. Lawton. May 1958. 25p. Contract AT-11-1-GEN-14. $0.75(OTS).

16558 AEC-tr-3363

GENERAL DETERMINATION OF THE AMOUNT OF INFORMATION. I. M. Helfand and A. M. Yaglom. Translated by Oak Ridge National Lab. Library Staff from Doklady Akad. Nauk S.S.S.R., 111, 745-8(1956). 6p.

Calculation and estimation of the amount of information using limiting transfers are considered. (T.R.H.)

16559 AEC-tr-3369

THEORY OF OPERATING RELIABILITY OF SYSTEMS CONTAINING A LARGE NUMBER OF ELEMENTS. S. R. Bebiashibi. Translated by Oak Ridge National Lab. Library Staff from Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, No. 10, 29-39(1955). 14p.

The reliability of systems composed of a large number of cells was investigated. Probability damage values of the individual cells were assumed to be equal, and it was also assumed that the operating times of the units are normally distributed. It is pointed out that in large systems, cells with different probability damage values and with different distribution laws are encountered; however, the schemes for solving these are not considered. (J.R.D.)

16560 NP-tr-121

ON THE EXPEDIENCY OF USING THE ALTERNATIVE SCHWARTZ METHOD IN ELECTRONIC DIGITAL MACHINES. M. A. Aleksidze. Translated by Morris D. Friedman (Lincoln Lab., MIT) from Doklady Akad. Nauk S.S.S.R., 120, 231-4(1958). 6p.

The total calculation time by the alternative Schwartz method is compared with the total time without using the method. Times are calculated using the super-relaxation method and Liebmann iteration. (W.D.M.)

16561

VARIATIONAL METHODS BASED ON THE DENSITY MATRIX. N. H. March and W. H. Young (The University, Sheffield, Eng.). Proc. Phys. Soc. (London) 72, 182-92(1958) Aug.

A method of setting up variational density matrices which satisfy the necessary subsidiary conditions is discussed, and some explicit variational forms are presented. Each variational matrix is defined essentially in terms of the density matrix for a known problem, for example a system of free particles in a box, using either stationary wave or progressive wave solutions. The latter form is shown, by suitable transformation along lines suggested by earlier work of Macke, to lead very directly to a method intimately connected with that proposed by von Weizsäcker, and a completely quantum-mechanical variational basis for this method is thereby provided. One- and three-dimensional cases for particles moving in a common potential are considered explicitly, and ways of achiev-

ing greater accuracy than is possible with von Weizsäcker's scheme are clear, especially in the three-dimensional case. A simple example is worked out in order to compare the results obtained from the various approximate variational forms with the exact density matrix for a linear harmonic oscillator potential, and the results are encouraging. (auth)

16562

SEPARABLE DYNAMICAL SYSTEMS OF STAECKEL IN FLAT SPACE. Giiti Iwata (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 19, 369-74(1958) Apr.

In a study of the orbits of high-energy charged particles in electromagnetic fields, coördinate systems and respective potential functions were determined when the Hamilton-Jacobi equation of the particles is integrable by separation of variables. (auth)

16563

THEORY OF GROUPS AND ITS APPLICATION IN PHYSICS. Grigoriy Yakovlevich Lyubarskiy. Moscow, Gostekhizdat, 1957. 354p.

A revision is presented of a series of lectures on group theory and its application to physics. The fundamentals of the theory are given, and certain concrete groups are studied. A compact, but detailed and systematic, theory of group representation is presented. The principles of the application of abstract concepts of group representation to theoretical physics are shown. (J.S.R.)

Measuring Instruments and Techniques

16564 BNL-3728

Brookhaven National Lab., Upton, N. Y.

PULSE SHAPING FOR NUCLEAR SPECTROMETRY. Robert L. Chase. [May 15, 1958]. 16p. Contract [AT-30-2-gen-16]. $3.30(ph OTS); $2.40(mf OTS).

The pulse-shaping techniques with respect to pulse duration, base line stability, pile-up overloading, low-frequency noise, and mid-band noise are discussed. It is pointed out that the proper choice of pulse shaping in a particular application is not always clear cut, and considerable difference of opinion exists, each technique having its advocates. (J.R.D.)

16565 HW-54287(Rev.)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A PORTABLE TRANSISTORIZED GAMMA ENERGY ANALYZER. W. G. Spear. Mar. 25, 1958. 19p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

A scintillation, portable, transistorized gamma energy analyzer was developed, designed, and fabricated in experimental form. It performs satisfactorily, utilizing the gamma photoelectric effect, in gamma radiation field levels from 0.01 to 1.0 mr/hr. Adjustments permit operation in other field strengths. The experimental instrument weighs seven pounds and the battery life for continuous operation is about 250 hours. As presently adjusted, the gamma energy span on the 10-turn dial is from about 100 kev to 1.5 Mev with a minimum stable window width or gamma energy delineation of 10 to 20 kev thereby giving good energy resolution. By utilizing one adjustment, the gamma energy span may be moved to as high an energy as desired. The system resolution, using Cs^{137} source was found to be about 13 per cent, which is adequate for the use for which the instrument is intended. (auth)

16566 HW-55633

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

AN EXPERIMENTAL SCINTILLATION DOSE-RATE METER—MODEL II. W. G. Spear and L. V. Zuerner. June 2, 1958. 20p. Contract W-31-109-Eng-52. $0.75 (OTS).

A terphenyl in polystyrene crystal 0.125 in. thick was utilized in the development of an experimental scintillation beta-gamma dose-rate meter to produce a stable, low drift, five-range instrument with a first-range sensitivity of 0.5 mr/hr. (W.D.M.)

16567 AEC-tr-3339

ON THE ENERGY RESOLUTION OF SCINTILLATION COUNTERS. L. S. Kukushkin and A. M. Ratner. Translated by Lydia Venters (Argonne National Lab.) from Zhur. Tekh. Fiz. 28, 345-50(1958). 11p.

The dispersion of light emitted from various crystal positions was studied as a component part of the scintillation counter dispersion. Calculations were made of sodium iodide cylindrical crystals of various shapes and dimensions. The effects of the optical contact between the crystal and the photomultiplier on the light collection were investigated. The calculation resulted in obtaining a curve for the emitted light dispersion strongly differing from the Gaussian curve, thus contributing new data for counter dispersion. (auth)

16568

MOULDED POLYSTYRENE SCINTILLATORS. H. De Waard, W. Prins, and A. Prins (Rijksuniversiteit Groningen, Netherlands). Appl. Sci. Research B3, 372-6(1952-4).

Luminescent solid solutions of 1,4-diphenyl-butadiene (DPB), 1,6-diphenyl-hexatriene (DPH), and 1,1,4,4-tetraphenyl-butadiene (TPB) in polystyrene were made by a process of slow injection molding. The DPB and DPH solutions thus prepared give a much larger fluorescent light output than solutions polymerized in bulk. The fluorescence yield of a DPB-solution approaches that of TPB plastic. Differences are also observed in the fluorescence spectra of molded and polymerized DPB and DPH plastics. Little difference is observed in the fluorescence of molded and polymerized TPB plastics. The poor fluorescence of the polymerized diphenyl-polyene solutions can be explained by assuming a chemical reaction in the polyene chain during the polymerization which cannot take place in the TPB solution, where four phenyl groups enclose the butadiene core. (auth)

16569

RADIATION MEASURING INSTRUMENTS. H. U. Becker. Atomwirtschaft 3, 347-51(1958) Aug.-Sept. (In German)

The development in the German Federal Republic of facilities for manufacturing and supplying radiation measuring instruments is discussed. At the present there are about twenty firms engaged in this work. Some of the firms manufacture the instruments, while others act as sales agents for foreign producers. The value of domestic production was 9.5 Mio. DM in 1957. (J.S.R.)

16570

SPECTRAL DISTRIBUTION OF SCATTERED RADIATION FROM A KILOCURIE COBALT 60 UNIT. D. V. Cormack (Univ. of Saskatchewan, Saskatoon, Can. and Saskatoon Cancer Clinic, Can.) and H. E. Johns (Univ. of Toronto, and Ontario Cancer Inst., Toronto). Brit. J. Radiol. 31, 497-502(1958) Sept.

The spectral distribution of scattered radiation from a cobalt-60 therapy unit has been calculated. Spectra

are given for once- and multiply-scattered radiation from the cobalt metal source and from the tapered sides of a lead collimator. Calculations of the attenuation of the cobalt beam including the scattered components are in good agreement with experimental data. (auth)

16571

A PAIR SPECTROMETER FOR THE MEASUREMENT OF GAMMA QUANTA TO 26 Mev. R. Balzer, H. Knoepfel, P. Stoll, and W. Wölfli (Physikalisches Institut, Zürich). Helv. Phys. Acta 31, 328-30(1958). (In German)

The design and construction of a pair spectrometer with a greatly improved light intensity are described. At 8 Mev the light intensity is of the order of 10^{-6} measured pairs per incident photon in comparison with the usual value of 10^{-7}. (J.S.R.)

16572

THE DESIGN, PERFORMANCE AND USE OF FISSION COUNTERS. W. Abson, P. G. Salmon, and S. Pyrah (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Brit. Nuclear Energy Conf. 3, 201-9 (1958) July.

The basic design criteria for electron-collection fission counters are discussed; data are presented on the effect of thickness of fissile material on sensitivity and the effect of electrode spacing and gas pressure on pulse height. High detection efficiencies are obtained with electrode coatings of 1 mg/cm^2, and thicknesses up to 2 mg/cm^2 may be used when high sensitivities are required. When argon is used as the filling gas the product of gas pressure and electrode spacing (pd, in atmosphere-cm) should lie in the region 0.4 to 1.0, the higher value being preferable if it does not give rise to difficulties in ionization collection. The operating level of the discriminator bias is usually determined by the effect of α-activity in the fissile material. Typical values of the operating bias level at which a high detection efficiency is possible correspond to 5 to 20 Mev particle energy. The designs of several types of fission counter are described, illustrating experimental applications and the use of this type of detector in reactor instrumentation systems. (auth)

16573

BORON-TRIFLUORIDE PROPORTIONAL COUNTERS. W. Abson, P. G. Salmon, and S. Pyrah (Atomic Energy Research Establishment, Barwell, Berks, Eng.). J. Brit. Nuclear Energy Conf. 3, 210-18(1958) July.

The design and manufacture of a variety of types of boron-trifluoride proportional counter are described. One basic design and method of assembly is used for the manufacture of counters of sizes ranging from ½ in. diam and a few inches long to 2 in. diam and several feet long. The technique of manufacture is suitable for large-scale production, and consistently good electrical characteristics can be obtained. Details are given of the opening characteristics of a wide range of counters, and the effect of circuit parameters on the output pulse amplitude is discussed. Measurements on the γ-response of medium-size counters show that they can be used to discriminate between neutrons and γ-radiation at γ dose-rates of 100 to 200 r/h. The counters can be used for long periods at temperatures up to 100°C without significant deterioration in characteristics. The counting life is found to be a function of counter size and of gas multiplication, and is probably limited by dissociation of BF_3 and the formation of electron-capturing dissociation products. A typical medium-size counter, e.g. 1 in. diam by 6 in. long, can be used for 10^{11} counts at a gas-multiplication factor M of 10, before significant deterioration of the counting characteristics occurs. Some applications of BF_3 proportional counters, such as in reactor instrumentation, and the use of large counter arrays in nuclear physics experiments, are discussed briefly. (auth)

16574

A SIMPLE PHASE SENSITIVE RECTIFIER FOR USE WITH RADIATION DETECTORS. J. C. S. Richards (Univ. of Aberdeen, Scotland). J. Sci. Instr. 35, 285-6 (1958) Aug.

The ratio of light to dark resistance of a cadmium selenide photocell is sufficiently great for the cell to be used effectively as a light controlled-switch. Where radiation incident on a detector is chopped at a frequency of less than 20 c/s, two such photocells can be used in a very simple arrangement to make a coherent demodulator which has the advantages of a mechanical rectifier without the usual disadvantages. (auth)

16575

A NUCLEAR PLATE CAMERA FOR ANGULAR DISTRIBUTION MEASUREMENTS WITH GASEOUS OR SOLID TARGETS OVER A WIDE RANGE OF ANGLES. W. M. Jones and D. G. Waters (Associated Electrical Industries Ltd., Aldermaston, Berks., Eng.). J. Sci. Instr. 35, 286-8(1958) Aug.

A nuclear plate camera for the investigation of the angular distributions of charged particles from either solid or gaseous targets is described. The instrument has been checked by comparing the angular distributions of deuterons elastically scattered from gold and xenon targets with the Rutherford scattering law down to 8° in the forward direction. (auth)

16576

A DOUBLE γ-RAY SPECTROMETER FOR COINCIDENCE COUNTING OF POSITRONS. J. W. Weale (Atomic Weapons Research Establishment, Aldermaston, Berks., Eng.). J. Sci. Instr. 35, 297-9(1958) Aug.

A double γ-ray spectrometer has been developed as a specific method for the counting of positrons in the presence of the other β- and γ-ray emitters. It has a discrimination factor about a hundred times better than a simple γ-ray spectrometer. A method of efficiency calibration including correction for the effect of positron-γ-ray coincidences is described. (auth)

16577

FATIGUE PHENOMENON ON THE CATHODE OF SELF QUENCHING GEIGER TUBES. Ottó Orient (Dept. of Radiology, Hungarian Academy of Sciences). Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közlemenyei 5, 577-81(1957) Nov.-Dec. (In Hungarian)

Work function and operational data (plateau length and slope) of Cu and Ni cathode counting tubes were studied after prolonged operation. According to these measurements the phenomenon of fatigue occurs in self quenching counters in prolonged operations not only in the gas mixture but on the cathode too. The work function of the counting tube increases at first rapidly with the number of counts, subsequently the rate of increase is reduced. The counting tube characteristics (plateau length and slope) are affected by the change in work function. (auth)

16578

A SCINTILLATION γ SPECTROMETER WITH AUTOMATIC RECORDING. Dezső Kiss, Lajos Matus, and Zoltán Zámori (Dept. of Physics for Experimental Reactors, Hungarian Academy of Sciences). Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének

Közlemenyei 5, 589-98(1957) Nov.-Dec. (In Hungarian)

A single-crystal scintillation spectrometer was built for measuring γ rays produced in (n,γ) reactions. The resolving power was found to be 9.5%; the non-linearity was less than 1% up to 4.4 Mev. The stability of the arrangement was satisfactory. For the full automatic plotting of the whole spectrum, 5 minutes are needed. A modification of the spectrometer is suggested making possible a direct reading of the line intensity from the peak height and calculations are carried out for a given case. (auth)

16579

RADIOASSAY OF CARBON-14 IN AQUEOUS SOLUTIONS USING A LIQUID SCINTILLATION SPECTROMETER. Daniel Steinberg (National Institutes of Health, Bethesda, Md.). Nature 182, 740-1(1958) Sept. 13.

A procedure is described which employs a liquid scintillation spectrometer for the direct counting of small amounts of carbon-14 in aqueous or alcoholic solutions. In addition, it permits quantitative recovery of the sample in its original form for further analysis. (C.H.)

16580

A HIGHLY SENSITIVE CHEMICAL DOSIMETER FOR IONIZING RADIATION. W. A. Armstrong and D. W. Grant (Defence Research Chemical Labs., Ottawa). Nature 182, 747(1958) Sept. 13.

Preliminary experiments indicate that doses of electromagnetic radiation in the range 5 to 100 rads may be measured with an accuracy of about 5% from the fluorescence induced in calcium benzoate solutions. Applications in aqueous dosimeters for radiobiological studies are discussed. (C.H.)

16581

IONIZATION MEASUREMENTS OF FAST PARTICLES IN NUCLEAR EMULSION. N. M. Viryasov and L. P. Pisareva (Joint Inst. of Nuclear Research). Pribory i Tekh. Ekspt. No. 2, 17-21(1958) Mar.-Apr. (In Russian)

The feasibility of quantitative ionization measurements in emulsions by using calibration tracks from an accelerator was investigated. The ratio of the number of blobs per track unit length for 148, 198, 250, 302, 464, and 657 Mev protons and 360 Mev π mesons was compared with the theoretical values of relative ionization losses. The ionization area was found in which experimental data is in agreement with theoretical values. Methods using the parameter d, which represents an effective grain dimension, are suggested as corrective measures for regions of high ionization. The formula for simple geometric calculations of the track inclination and method of necessary corrections are presented. (tr-auth)

16582

INTRODUCTION OF HYDROGEN AND DEUTERIUM INTO EMULSION. T. A. Romanova (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 2, 21-4(1958) Mar.-Apr. (In Russian)

A method was developed for introducing hydrogen and deuterium into emulsions. The method permits an increase of hydrogen content up to 0.6×10^{23} nuclei/cm^3 or an introduction of deuterium nuclei up to 0.3×10^{23} nuclei/cm^3 of dry emulsion. (tr-auth)

16583

NEW LIQUID SCINTILLATORS. Kh. V. Protopopov, Kh. A. Arslanov, S. B. Butomo, and T. V. Timofeeva (Radium Inst., Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 2, 24-8(1958) Mar.-Apr. (In Russian)

Possibilities of using various organic compounds as activators for liquid scintillators were studied. A considerable increase in the scintillation efficiency of methyl anthranilate solution in toluene was observed with the introduction of naphthalene. After oxygen removal from the liquid scintillators (by CO_2), the 2.5 g/l solution of methyl anthranilate in a mixture of 3% methanol, 15% naphthalene, and 82% toluene showed an efficiency of 1.26 for the 5 g/l terphenyl solution in toluene. (tr-auth)

16584

ON HETEROGENEOUS LIGHT COLLECTION IN A LARGE SIZE SCINTILLATOR. V. F. Grushin and A. N. Zinevich (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 2, 29-31(1958) Mar.-Apr. (In Russian)

A method is offered for reducing up to ± 12% the maximum deflection of light entering into photomultipliers during scintillation flashes. A circular plastic scintillator (R = 50 mm, thickness 10 mm), a transparent light pipe, and one multiplier tube were used in the experiment. (tr-auth)

16585

FAST ACTING AMPLITUDE ANALYZER WITH A "GRAY WEDGE". O. B. Likin (Inst. of Chemical Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 2, 36-40(1958) Mar.-Apr. (In Russian)

A design is given for a fast pulse analyzer based on the photographic spectra recording method using the "gray wedge." The amplitude resolution of the apparatus is equal to a 50 channel analyzer. The pulse recording accuracy is not lower than 6%. The resolving time of the apparatus is 3 μsec. Photographic materials and their treatment are discussed. (tr-auth)

16586

DETERMINATION OF HALFLIFE OF RADIOACTIVE ISOTOPES WITH BINARY STATISTICAL CALORIMETERS. N. S. Shimanskaya (Radium Inst., Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 2, 95-7 (1958) Mar.-Apr. (In Russian)

A binary statistical calorimeter is used in measurements of the Rn^{222} half life. The scheme of the calorimeter is included. (tr-auth)

16587

PULSING OF PHOTOMULTIPLIERS. U. Farinelli and R. Malvano (Univ. of Turin). Rev. Sci. Instr. 29, 699-701(1958) Aug.

Various ways of pulsing photomultipliers are investigated. Some drawbacks inherent to the conventional methods are pointed out; a new pulsing method is suggested and experimentally studied, which avoids these inconveniences. (auth)

16588

NOTE ON ACCELERATING COMPONENTS IN PARTICLE SPECTROMETERS. H. Mendlowitz (National Bureau of Standards, Washington). Rev. Sci. Instr. 29, 701-3(1958) Aug.

Some considerations on "energy aberrations" in electron spectrometers containing accelerating (decelerating) components are discussed with regard to their role in the measurement of the energies of electrons. Based on these considerations, design criteria are obtained for an electrostatic decelerating component for a given electron absorption spectrometer. The design criteria are derived by treating the problem of a charged particle in an electrostatic field by means of the Hamiltonian method in classical mechanics, and are found to be related to the curvature of the electrostatic field. (auth)

16589
RESPONSE OF A LIQUID SCINTILLATOR TO FAST NEUTRONS AND γ RADIATION. James E. Hardy (Univ. of British Columbia, Vancouver, Can.). Rev. Sci. Instr. 29, 705-9(1958) Aug.

The response of a commercially available liquid scintillator to $D(d,n)He^3$ neutrons and to γ radiation from several standard sources has been measured. It is found that the pulse-height response to γ-ray energy is linear in the energy range 0.5 to 2.6 Mev, and that the fast neutron detection efficiency of a disk scintillator 5 cm thick is about 30% in the neutron energy range 2 to 3.5 Mev, and varies with neutron energy E as $\xi(E) = 0.146 + 0.45/E + 0.82$, where E is measured in Mev. (auth)

16590
ELECTRONIC MEASURING INSTRUMENTS. Second edition, Revised. E. H. W. Banner. London, Chapman & Hall, Ltd., 1958. 508p.

A survey of electronic measuring instruments is presented in four parts: characteristics of indicating instruments; electronic devices (hot- and cold- cathode tubes, cathode-ray tubes, photoelectric devices, metal and crystal rectifiers, non-linear conductors, and radiation and particle detectors); electronic instruments (measuring instruments using tubes, cathode-ray instruments, photoelectric measuring instruments, rectifier instruments, radiation measuring instruments, and the radiation thickness gage); quasi-electronic instruments and electronic devices used directly (electronic and related counters, instruments using electromechanical transducers for measuring non-electrical quantities, electrical instruments, and instruments for physical quantities. (T.R.H.)

Mesons

16591 BNL-3369
Brookhaven National Lab., Upton, N. Y.
SOME PROPERTIES OF THE QUARTIC ANALYSIS OF PHOTOMESON ANGULAR DISTRIBUTION. Michael J. Moravcsik. [1957]. 7p. $1.80(ph OTS); $1.80(mf OTS).

Comments on application of the quartic method to photomeson angular distributions are given, and a suggestion which increases the practicability of the method is offered. (T.R.H.)

16592 UCRL-8364
California. Univ., Berkeley. Radiation Lab.
ANALYSIS OF THE BEVATRON K^- BEAM BY MEANS OF AN EMULSION STACK. John N. Dyer. July 3, 1958 8p. Contract W-7405-eng-48. $0.50(OTS).

The Bevatron K^- beam separated by the velocity spectrometer was analyzed with the aid of an emulsion stack, and particle density and distributions are given. (auth)

16593 JPRS-608
SCATTERING OF 333-MEV NEGATIVE PIONS ON HYDROGEN. V. G. Zinov and S. M. Korenchenko. Translated from a publication of the Joint Institute of Nuclear Research. 4p.

Available from Photoduplication Service, Library of Congress.

The values of the differential cross sections for elastic scattering of 333 ± 9 Mev negative pions on hydrogen are presented. (W.D.M.)

16594
NEW EVIDENCE FOR A PARTICLE OF MASS ~ 525 M_e. Nilima Basu and M. S. Sinha (Bose Inst., Calcutta). Indian J. Phys. 32, 259-66(1958) June.

While photographing stopped muons in a multiplate cloud chamber, nine pictures were obtained in which the rate of change of ionization of the particles and their residual ranges were not compatible with that shown either by mu-mesons or by protons. Their mass values were obtained by measuring their change in ionization in the successive gaps and their decrease in residual ranges. Ionization was measured by drop counting. It was found that five of these particles gave an average mass value 528 ± 34 m_e and the remaining four an average of 280 ± 21 m_e. The close proximity of the latter value with the pion mass is a strong indication for the correctness of the method employed. A probable decay event of the particle of mass ~ 528 m_e is given. (auth)

16595
THE ANGULAR DISTRIBUTIONS OBTAINED FROM THE DIFFERENT THEORIES OF MULTIPLE MESON PRODUCTION. György Bozóki and Éva Gombosi (Dept. of Cosmic Radiation, Hungarian Academy of Sciences). Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közlemenyei 5, 537-55(1957) Nov.-Dec. (In Hungarian)

On the basis of the Landau theory of meson production the differential and integral angular distributions of the particles produced were investigated in the case of nucleon-nucleon collision in dependence on the quantity $\alpha = \bar{\gamma}_0 \operatorname{tg} \vartheta$ and compared with the distributions resulting from the Fermi and Heisenberg theory and the angular distribution $\cos^4 \vartheta$, respectively. With the help of the distributions obtained the function $F/(1-F) = f(\alpha)$ was calculated. In the case of the investigated angular distribution of jets the results thus obtained made possible the comparison of the experimental and theoretical distributions as well as the determination of the primary energy. Further, the angular distribution in the case of nucleon-nucleus collision was investigated on the base of the Landau theory. (auth)

16596
PHOTOPRODUCTION OF NEUTRAL PIONS AT ENERGIES 500 to 940 Mev. J. I. Vette (California Inst. of Tech., Pasadena). Phys. Rev. 111, 622-31(1958) July 15.

The process $\gamma + p \rightarrow \pi^0 + p$ was studied by detecting recoil protons from a liquid hydrogen target which was bombarded by the bremsstrahlung beam of the California Institute of Technology electron synchrotron. The angle and momentum of the recoil protons were measured by a magnetic spectrometer-three scintillation counter coincidence system. The process was studied between photon laboratory energies of 490 and 940 Mev and between pion center-of-mass angles of 31.5 and 147°. Protons which arose from meson pair production were significant at forward laboratory angles. A correction for this contamination is discussed. The results of these measurements show two interesting features. One is that the total cross section, which falls very rapidly above the $\frac{3}{2} - \frac{3}{2}$ resonance energy near 320 Mev, reaches a minimum at about 600 Mev, and then increases to a broad maximum near 800 or 900 Mev. The other striking feature of the data is that the shape of the angular distribution seems to change rather suddenly near 900 Mev. (auth)

16597
PRODUCTION OF STRANGE PARTICLES BY π-NUCLEON AND PHOTONUCLEON INTERACTIONS

NEAR THRESHOLD. Robert K. Adair (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 111, 632-9 (1958) July 15.

An investigation of the behavior of the π-nucleon reaction cross sections near the strange particle threshold shows that the variation with energy of the Λ^0-K cross section near the $\Sigma-K$ threshold depends strongly upon the relative parities of the Σ and the Λ^0 hyperons. If the elements of the Wigner R matrix are nearly stationary near the $\Sigma-K$ threshold, and if the decay of the compound system is nearly independent of its mode of formation, the variation of the Λ^0 and Σ cross sections is almost uniquely established from cross sections measured at one energy. In particular, the Λ^0 cross section exhibits strong cusps at the $\Sigma-K$ thresholds. Angular distributions and polarizations are discussed from the viewpoint of these assumptions. The photonucleon production of strange particles is shown to be closely related to the π-nucleon production, essentially because the same final-state interactions are important. The strength and characteristics of these interactions lead to the conclusion that the matrix elements for photonucleon production of strange particles will, in general, be strongly affected in magnitude by the final-state interactions and they will not be real, even at threshold. The analysis of cusps, which are predicted in the $\gamma + p \rightarrow \pi +$ nucleon cross section at the $\Lambda^0 + K$ threshold and the $\Sigma + K$ threshold, and in the $\gamma + p \rightarrow \Lambda^0 K$ reaction at the $\Sigma + K$ threshold, should provide a means of determining the relative parities of the strange particles, in a manner almost independent of the dynamics of the reaction. (auth)

16598

π^+ PRODUCTION IN Al AND C BY 209-Mev POLARIZED PROTONS. E. Heer, A. Roberts, and J. Tinlot (Univ. of Rochester, N. Y.). Phys. Rev. 111, 640-4(1958) July 15.

The production of π^+ mesons by 209-Mev polarized protons incident on aluminum and carbon was studied at production angles of 92° (for both elements) and 120° and 144° (for Al alone). Normalized right-left asymmetries of the order of -0.5 are observed at 92° in both elements and for mesons in the range 26–51 Mev. The asymmetry appears to decrease rapidly with increasing production angle. The absolute production cross sections are determined with statistical uncertainties of about 10%. The cross sections at 92° are approximately proportional to the atomic weights of the two target materials, and the angular distribution in Al is almost isotropic for all meson energies. (auth)

16599

SEARCH FOR EVIDENCE OF PARITY NONCONSERVATION IN π^+-MESON PRODUCTION BY POLARIZED PROTONS. E. Heer, A. Roberts, and J. Tinlot (Univ. of Rochester, N. Y.). Phys. Rev. 111, 645-6(1958) July 15.

A search was made for evidence of parity nonconservation in π^+-meson production in aluminum. Mesons of mean energy 40 Mev were produced at 92° by 209-Mev polarized protons, and the numbers of mesons emitted parallel and antiparallel to the polarization direction were compared. No significant asymmetry was found, indicating that the parity-mixing coefficient $F^2 \leq 2 \times 10^{-3}$. (auth)

16600

TIME-REVERSAL INVARIANCE AND RADIATIVE MUON DECAY. R. H. Pratt (Univ. of Chicago). Phys. Rev. 111, 649-51(1958) July 15.

The radiative muon decay $\mu \rightarrow e + \nu + \bar{\nu} + \gamma$ is investigated as a source of information on the time-reversal properties of the muon decay interaction. It is shown that for any muon decay process, which may include electromagnetic interactions, terms in the transition probability which violate time-reversal invariance must be pseudoscalars. Further, only ten combinations of the coupling constants of the four-fermion interaction can occur in the transition probability. These may be classified in accordance with the types of terms in which they occur; a term which violates time-reversal invariance must contain as a factor either the electron mass or the transverse electron polarization. In the radiative muon decay, if such a term is proportional to the electron mass, it will also contain as a factor the longitudinal electron polarization. (auth)

16601

PHOTOPION CROSS SECTIONS AND A SECOND RESONANCE. Ronald F. Peierls (Cornell Univ., Ithaca, N. Y.). Phys. Rev. Letters 1, 174-5(1958) Sept. 1.

It was recently suggested that the rise in the photopion cross sections above 500 Mev may be interpreted as being due to another resonance in the pion-nucleon system. Since the π^+ cross section is the larger, the resonance must presumably be in a $T = \frac{1}{2}$ state. From observation of the angular distributions, it is also possible to determine the probable angular momentum and parity of such a state. (W.D.M.)

16602

DETERMINATION OF THE PARITIES OF STRANGE PARTICLES FROM DISPERSION RELATIONS. Saul Barshay (Brookhaven National Laboratory, Upton, N. Y.). Phys. Rev. Letters 1, 177-9(1958) Sept. 1.

It has recently been suggested that the parities of the $K-\Lambda$ and $K-\Sigma$ systems relative to the nucleon might be determined from the forward angle dispersion relations applied to the scattering of K^+ and K^- mesons by nucleons. Experimental results and theory are combined in an attempt to determine the relative parities of the strange particles. (W.D.M.)

16603

ANTI-LAMBDA HYPERON. D. J. Prowse (Univ. of California at Los Angeles) and M. Baldo-Ceolin (Univ. of Padua). Phys. Rev. Letters 1, 179-80(1958) Sept. 1.

An event found in an emulsion stack exposed to a 4.6 ± 0.3 Bev π^- meson beam at the Berkeley Bevatron has been interpreted as the decay of an anti-lambda hyperon $\bar{\Lambda}^0$. The threshold for production with a free nucleon is 4.73 Bev and extends down to ~ 4.3 Bev with a bound nucleon, the reaction being of the type $\pi^- + p \rightarrow \Lambda^0 + \bar{\Lambda}^0 + n$. The side of the stack was exposed to a beam of 10^6 π mesons per sq cm, the intensity falling off by a factor of 10^3 in a distance of 8 in. across the emulsion sheets. (W.D.M.)

16604

PHOTOPRODUCTION OF π-MESONS FROM BORON. I. S. Hughes and P. V. March (Univ. of Glasgow). Proc. Phys. Soc. (London) 72, 259-62(1958) Aug.

The reaction $B^{11}(\gamma,\pi^-)C^{11}$ was studied using bremsstrahlung having peak energies from 70 to 320 Mev, by measuring the activity of the C^{11} product of the reaction. The cross section for the reaction is in agreement with theoretical values for surface production. An unexplained activity is detected below the energy threshold for meson production. (auth)

16605

PION AND MUON DECAY. J. M. Cassels (Univ. of Liverpool). Proc. Roy. Soc. (London) A246, 463-6 (1958) Aug. 26.

The nonconservation of parity in pion and muon decay

is discussed. The decay equations, pion decay $\sigma_\mu = C_{p\mu}$ and muon decay $I = A + D\sigma_\mu \cdot P_e$, both violate parity in that the first equates an axial vector to a polar vector, and the second adds together a scalar and a pseudoscalar. (W.D.M.)

16606

PARITY VIOLATION IN STRANGE-PARTICLE DECAYS. A. Salam (Imperial Coll., London). Proc. Roy. Soc. (London) A246, 482-90(1958) Aug. 26.

The history of nonconservation of parity is discussed, and experimental results are compared. The relevant decays are divided into two distinct classes: those involving the neutrino as a decay product and nonneutrino decays. (W.D.M.)

16607

ON THE LONGITUDINAL AND TRANSVERSE POLARIZATION OF POSITRONS IN μ^+-MESON DECAY. Shoichi Hori and Akira Wakasa (Kanazawa Univ., Japan) and Hiroshi Segawa (Fukui Univ., Japan). Progr. Theoret. Phys. (Kyoto) 19, 249-56(1958) Mar.

The density matrix which characterizes the polarization state of positrons emitted from μ^+-meson decays at rest was calculated, using general parity non-conserving interactions, the mass of the electron being neglected. From the density matrix, the degree and direction of polarization of the positrons are determined. Detection of transverse polarization perpendicular to the plane spanned by the polarization vector of the initial μ^+-meson and the propagation vector of the positron, will provide a test for whether invariance under Wigner's time reversal is valid. (auth)

16608

ON THE STATIC APPROXIMATION OF THE γ_5 MESON THEORY. Akira Kanazawa (Hokkaido Univ., Sapporo, Japan). Progr. Theoret. Phys. (Kyoto) 19, 330-8(1958) Mar.

The 1/m correction to the static approximation assumed by Sugawara was estimated within the non-recoil framework in the case of low energy pion-nucleon scattering. It is assumed that the Foldy transformation generates a valid static hamiltonian in the relativistic γ_5-theory. It is shown that two extra parameters appear besides three renormalized coupling constants known thus far in describing S- and P-wave pion-nucleon scattering. However, a crude numerical estimate shows that they may be quite negligible. Another effect of the 1/m correction is to modify the numerical values of three coupling constants, which would, according to the present rough numerical estimate, not be so great as invalidating the static approximation assumed by Sugawara. (auth)

16609

MASS LEVELS AND RELATIVE PARITIES OF BARYONS. Hiroshi Katsumori (Iowa State Coll., Ames). Progr. Theoret. Phys. (Kyoto) 19, 342-4(1958) Mar.

That observed mass level ordering of Ξ, Σ, Λ, and N comes chiefly from charge independent baryon-K interaction, assuming suitable parity for each baryon. (W.D.M.)

16610

THE NON-INDICATION OF THE "ANOMALOUS" SCATTERING OF MU-MESONS. S. Fukui (Osaka Univ.) and T. Kitamura and Y. Watase (Osaka City Univ.). Progr. Theoret. Phys. (Kyoto) 19, 348-51(1958) Mar.

A study of μ meson scattering was performed by means of an apparatus capable of selecting only muons, their momenta being determined by a thick absorber and a delayed coincidence method within a narrow range of (1 ± 0.15) Bev/c. The observed angular distribution of scattered muons was found to be in good agreement with the Coulomb scattering theory for extended nuclei obtained by Cooper and Rainwater. (W.D.M.)

16611

π-N INTERACTIONS IN Gev REGION. Yujiro Kakudo (Osaka Univ.); Tetuo Goto (Nihon Univ., Osaka); and Ryuzo Nakasima (Osaka City Univ.). Progr. Theoret. Phys. (Kyoto) 19, 353-8(1958) Apr.

π-N interactions in an energy region near 1.0 Bev are studied by means of the simple ray optical model. The energy dependence of the optical parameters, the absorption coefficient K, and the index of refraction k_1, are determined so as to reproduce the behaviors of the real and imaginary parts of the forward scattering amplitude, which are calculated from the observed total cross sections σ_T by making use of the dispersion relations. The target radius of the nucleon is taken as 1.3, 1.5, or 1.6×10^{-13} cm and is assumed to have no energy dependence. (auth)

16612

PARITY-NONCONSERVATION AND THE SPINS OF THE STRANGE PARTICLES. Kiyomi Itabashi (Tohoku Univ., Sendai, Japan). Progr. Theoret. Phys. (Kyoto) 19, 359-68(1958) Apr.

Taking into account possible parity-nonconservation in weak interactions, the decay angular distributions of strange particles produced by pion-nucleon collisions are re-examined. It is shown that, when the parity-nonconservation effect is actually observed in the decay angular distribution of the hyperon, its spin value can be determined less ambiguously than in the case of the parity-conservation. Especially, in this case, it is possible in principle to decide completely whether the spin is $\frac{1}{2}$ or not. The effect of the parity-nonconservation can appear also in the K_{μ^2}- and K_{π^3}-modes of decay, unless the spin of K is zero. The possibility of determining the spin value of the K-meson is considered. In this case the conclusion is not so decisive as the case of the hyperon. (auth)

16613

ON THE PROCESS OF CHARGED π-MESON PRODUCTION ON CARBON BY 670 Mev PROTONS. L. S. Azhgirei, I. K. Vzorov, V. P. Zrelov, M. G. Mescheryakov, and V. I. Petrukhin (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 34, 1357-66(1958) June. (In Russian)

A specially designed magnetic spectrometer was employed to measure the energy spectra of π^+- and π^--mesons produced in (p + C)-collisions. The measurements were carried out at an angle of 56° to the proton beam. The π-meson (+ and −) spectra were found to possess a maximum at about 110 Mev and could still be detected as far as ~400 Mev. Smearing out of the high energy side of the spectrum is interpreted as indicating partial formation of π-mesons within the nuclei on correlated nucleon groups with large relative momenta. The differential cross sections for π^+- and π^--meson formation were found to be $(5.1 \pm 0.8) \times 10^{-27}$ and $(1.0 \pm 0.2) \times 10^{-27}$ cm²/sterad. In the c.m.s. of the two colliding nucleons the π^+- and π^--meson angular distributions are close to isotropic. The measured ratio of π^+- and π^--meson yields is not consistent with the predictions of the simple model of π-meson production via excitation of the nucleon to an intermediate state with $T = J = \frac{3}{2}$ and indicates that inelastic collisions in the state with T = 0 play a significant role. (tr-auth)

16614

ENERGY SPECTRA AND ANGULAR DISTRIBUTIONS OF π^+-MESONS PRODUCED ON CARBON BY 660 Mev

PROTONS. A. G. Meshkovskii, Ya. Ya. Shalamov, and V. A. Shebanov. Zhur. Eksptl'. i Teoret. Fiz. 34, 1426-33(1958) June. (In Russian)

The energy spectra of π^+-mesons produced by 660 Mev protons on carbon were measured at five angles from 19° 30′ to 65°. The absolute cross sections $d\sigma_+/d\Omega$ were also measured. In the c.m.s. of the two colliding nucleons the mean π^+-meson energy was found to be independent of the angle of emission and was 100 Mev. Conclusions are drawn concerning the angular distribution of π^+-mesons; the total cross section for their production on carbon by 660 Mev protons is estimated and found to be $(46.7 \pm 5.1)\ 10^{-27}$ cm^2. The probability for production of π^+-mesons in p–p-collisions in the carbon nucleus is twice as small as the analogous probability for free p–p-collisions. (tr-auth)

16615

HEAVY NEUTRAL MESON: DECAY AND THE METHOD OF DETECTION. Ya. B. Zel'dovich (Inst. of Chemical Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 1644-6(1958) June. (In Russian)

Classifications of elementary particles assume the existence of mesons with 0 strangeness and 0 isotopic spin (expressed by p). Such particles must be neutral, and in strong interactions with nuclei, they are formed singly in two-nucleon collisions. Possible schemes for ρ decay and the experimental methods for its detection are investigated. It was evident that the ρ mass is larger than π^0 mass because the ρ mass was not observed during the experiment in which π^0 was formed. Transitions of $\rho \rightarrow 2\pi^0$ or $\rho \rightarrow \pi^+ + \pi^-$ are impossible because of differences in parities: the 2π mesons in $L = 0$ condition have even parity and ρ has odd. (R.V.J.)

Meteorology

16616 SCL-T-194

AERODYNAMIC CONDITIONS FOR DROPPING AEROLOGICAL APPARATUS. (Aerodinamicheskiye Usloviya Sbrasyvaniya Aerologicheskikh Priborov). S. I. Nepomnyashchiy. Translated by Marcel I. Weinreich (Sandia Corp.) from Priborostroenie, No. 4, 51-64 (1957). 23p.

The dropping of meteorological apparatus from airplanes with the aid of parachutes is investigated. In order to insure a normal operation of the instruments, it is indispensable to reduce to a minimum the weight acting on the instruments during the opening of the parachute. It is also necessary to guarantee the proper speed of the parachuting. The basic cases of the falling of such apparatus are examined. (W.D.M.)

16617

USE OF NUCLEAR RADIATION IN HYDROMETEOROLOGY. Aleksey Ivanovich Danilin. Leningrad, Gidrometeoizdat, 1957. 67p.

The purpose of this booklet is to provide engineers and technicians working in meteorology and hydrology, as well as soil specialists interested in water in relation to ground and soils, with a concise review of general information on nuclear radiation, the methods of measuring it, and the possible use of various isotopes for hydrometeorological tests. A description is given of a field instrument for measuring the moisture content in soil and water reserves in snow cover. An improved technical procedure is introduced by replacing the common soil-weight evaporator with a gamma radiation device for measuring the radiation penetrating the soil cover. (J.S.R.)

Molecular Properties

16618

A THEORETICAL STUDY OF THE FLUORINE MOLECULE. J. Eve (King's Coll., Newcastle upon Tyne, Eng.). Proc. Roy. Soc. (London) A246, 582-9(1958) Aug. 26.

A calculation, on the ground state of the F_2 molecule, was carried out using approximations inherent in Roothaan's method. Approximations to the ionization potentials, certain of the excitation energies, and the quadrupole moment were obtained from solutions which also predicted an unstable molecule. For the purpose of comparison, simplified equations resulting from neglecting inner- and outer-shell mixing were also solved. A limited configuration interaction calculation was carried out for the ground state of F_2; a fairly good value for the binding energy resulted. (auth)

Neutrons

Refer also to abstract 16555.

16619 CRGP-784

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

COMPILATION OF THERMAL NEUTRON CAPTURE GAMMA RAYS. G. A. Bartholomew and L. A. Higgs. July 1958. 147p. (AECL-669). $2.50(AECL).

Results obtained in measurements at the Chalk River Laboratories of energies and absolute intensities of γ rays following thermal neutron capture in various materials are reviewed. A compendium of energies, absolute intensities, and spectral distributions, together with a complete bibliography, of neutron capture γ rays from information available as of June 1958 are presented. (W.D.M.)

16620 NDA-92-2(Rev.)

Nuclear Development Corp. of America, White Plains, N. Y.

SUMMARY OF NDA UNCLASSIFIED RESULTS OF MOMENTS CALCULATIONS FOR THE PENETRATION OF NEUTRONS THROUGH VARIOUS MATERIALS. A. D. Krumbein. Aug. 30, 1957. Revised Apr. 1958. 42p. For General Electric Co. Aircraft Nuclear Propulsion Dept. Subcontract (AT-74)-ANPG-05339.

The unclassified results presently available at NDA for the penetration of neutrons through hydrogen, water, carbon, beryllium, and several hydrocarbons are summarized. The moments method was used throughout. Point isotropic sources were obtained and used in all the calculations except for one carbon problem. Most of the results are for fission sources but monoenergetic sources were included for several of the materials. Results are given in the form of both graphs and tables for the differential number spectra as functions of penetration depths. In addition, doses are given where they have been calculated. Where available, the fitting parameters, C_i and B_i or $\sqrt{B_i}$, are included in the results. (auth)

16621 ORNL-2197

Oak Ridge National Lab., Tenn.

EFFECTIVE NEUTRON REMOVAL CROSS SECTIONS FOR CARBON AND OXYGEN IN CONTINUOUS MEDIUMS. D. K. Trubey and G. T. Chapman. Sept. 19, 1958. 33p. Contract W-7405-eng-26. $1.00(OTS).

An expanded version of a paper previously published in ORNL-2081, p.167 (1956).

Thermal-neutron flux measurements at the Lid Tank

Shielding Facility in water, oil, and a sugar–water solution have been used to calculate effective neutron removal cross-section values of carbon and oxygen distributed in continuous media. The values are 0.72 ± 0.05 barn for carbon and 0.92 ± 0.05 barn for oxygen. These values are somewhat lower than previously reported values determined by another method, but the differences may be attributable to experimental errors. (auth)

16622

THE EFFECTIVE BOUNDARY CONDITIONS IN NEUTRON DIFFUSION THEORY. G. A. Bat' and D. F. Zaretskii. Atomnaya Energ. 4, 510-19(1958) June. (In Russian)

A review is given of methods for determining the effective boundary conditions providing the coincidence derivation in the asymptotic region which coincides with the derivation of corresponding kinetic equations. The effective boundary conditions for multi-energy neutrons are studied on plane and cylindric surfaces of black and gray bodies. Data for effective boundary conditions for cylinders with arbitrary cross sections are presented. The simplest problem for determining effective boundary conditions for moderated neutrons in media with heavy atoms and scattering cross section not depending on energy is studied. A review includes data published in USSR and abroad. (tr-auth)

16623

THE ENERGY SPECTRUM OF NEUTRONS FROM A PULSED SOURCE IN A HEAVY MODERATOR WITH CONSTANT PATH LENGTH. M. V. Kazarnovskii. Atomnaya Energ. 4, 539-46(1958) June. (In Russian)

16624

SOME APPLICATIONS OF THE S_n METHOD. R. M. Kiehn (Los Alamos Scientific Lab., N. Mex.). Nuclear Sci. and Eng. 4, 166-79(1958) Aug.

The S_n technique, a method devised by B. G. Carlson to solve the transport equation, has been applied to a number of critical assembly problems. A comparison of computed and experimental results is given. (auth)

16625

FAST NEUTRON DOSIMETRY IN PILE IRRADIATIONS. R. Wayne Houston (Univ. of Pennsylvania, Philadelphia). Nuclear Sci. and Eng. 4, 227-38(1958) Aug.

For samples exposed in high neutron flux regions of reactors the contribution to the total dosage due to the recoils from elastically scattered fast neutrons may be significant. The calculation of this contribution is considered. Three methods are presented, each differing in the manner in which the details of the energy distribution of fast neutrons are treated. In the first, the neutron flux per unit energy interval is assumed to be of the asymptotic or 1/E form up to fission energies. In the second and third, a separate computation is made for the uncollided neutrons reaching the sample. The remaining contribution due to once-scattered neutrons is treated as in the first method, but alternate forms for the source spectrum of once-scattered neutrons are considered. Use of the equations requires only a knowledge of the thermal neutron flux in the vicinity of the sample. Assumptions and limitations are discussed. Numerical results are presented for comparison of the effects in light water, heavy water, and graphite moderated reactors in the irradiation of a hydrocarbon sample. (auth)

16626

FLUX DISADVANTAGE FACTOR IN PLANE SLAB LATTICES. E. Richard Cohen (Atomics International, Canoga Park, Calif.). Nuclear Sci. and Eng. 4, 255-6 (1958) Aug.

In the calculation of the neutron self-shielding a periodic plane lattice of nonscattering absorber, thickness 2a, and nonabsorbing moderator, thickness 2(b-a), was assumed. It is pointed out that under these assumptions a much simplier calculation is possible. (W.D.M.)

16627

VARIATIONAL CALCULATIONS OF LATTICE SELF-SHIELDING. Leland S. Bohl, John C. Stewart, and Norman C. Francis (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 4, 257-9(1958) Aug.

A variational method is presented which yields extremely accurate results with brief hand calculation in one-velocity lattice self-shielding problems. (W.D.M.)

16628

COLD NEUTRON SCATTERING IN BISMUTH. R. C. Bhandari (Tata Inst. of Fundamental Research, Bombay) and P. G. Khubchandani (Atomic Energy Establishment Trombay, Bombay). Phil. Mag. (8) 3, 798-800(1958) Aug.

It was found that absorption plus the theoretical one-phonon scattering cross section of cold neutrons in bismuth were larger than the observed cross section at 300 and 500°K. This discrepancy was attributed to the use of incoherent approximation in the calculations. To test the point, calculations were made without making use of incoherent approximation. The discrepancy is unresolved. (J.R.D.)

16629

NEUTRONS FROM THE p + d BREAKUP REACTION. Warren Heckrotte (Univ. of California, Berkeley) and Malcolm MacGregor (Univ. of California, Livermore). Phys. Rev. 111, 593-6(1958) July 15.

The high-energy end of the energy spectrum of neutrons from the p + d reaction at incident energies of about 10 Mev is examined. It is found that the structure in the spectrum measured by Nakada and co-workers can be attributed to the final-state interaction of the two protons. (auth)

16630

SCATTERING OF NEUTRONS ON NONSPHERICAL NUCLEI. E. V. Inopin (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 1455-64(1958) June. (In Russian)

A method for calculation of neutron scattering by semi-transparent nuclei based on the exact solutions of the wave equation in spheroidal coordinates is described. (tr-auth)

16631

ON THE ENERGY DEPENDENCE OF CROSS SECTIONS IN REACTIONS INDUCED BY SLOW NEUTRONS. F. L. Shapiro (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 1648-9(1958) June. (In Russian)

Nuclear Physics

16632 CRP-789

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

NUCLEAR REACTOR Q-VALUES. D. A. Bromley and A. R. Rutledge. Aug. 1958. 76p. (AECL-663). $2.00 (AECL).

Target nuclides considered were selected on the basis of natural stability or sufficiently long half life to make feasible their use as targets in nuclear reaction experiments. In each case the mass excess, natural isotopic abundance and, where applicable, the half life

are listed above the Q-value matrix. The structure of the matrix is self-explanatory; each entry lists the appropriate Q-value, the final nucleus and, where available, the experimentally determined Q-value. Space was left for addition of these values as they become available. The compound nucleus involved and its excitation at zero bombarding energy (i.e., the binding energies of the incident particle in the compound nucleus) can be read directly from the "γ out" column. Similarly, the binding energy of the emergent particle in the target nucleus is given by the entries in the "γ in" row. Two columns on the right of each matrix corresponding to 3-body disintegration are included since these channels compete with the two-body disintegration in some cases at relatively low incident energies, well within the range of existing electrostatic accelerators. (auth)

16633 NP-6926

Naval Research Lab., Washington, D. C.

NRL QUARTERLY ON NUCLEAR SCIENCE AND TECHNOLOGY. Progress Report for the Period April–June 1958. July 1, 1958. 46p.

Low-lying excited states in Cr^{51}, Fe^{56}, Ga^{70}, and Se^{75} were investigated by observing neutron thresholds in (p,n) reactions with V^{51}, Mn^{55}, Zn^{70}, and As^{75}. As a first step toward providing a unified description of space-time and of the "internal space" of an elementary particle, internal rotations are proposed, in terms of the geometry of the group-space of the proper Lorentz group, as the underlying framework for describing isotopic spin. A search for K^- meson collisions with free protons in nuclear emulsions was carried out in the energy range 0 to 82 Mev. Nineteen elastic scattering ($K^- + p \rightarrow K^- + p$) and fourteen absorption ($K^- + p \rightarrow \Sigma + \pi$) events were observed. The characteristics of these events are tabulated. The gamma spectrum resulting from Ga^{65} positron decay to Zn^{65} is presented. The basic design of the lens system for the NRL betatron–synchrotron is discussed. Solutions to the Boltzmann equation for an electron beam in an external field were obtained in connection with beam stability studies for a proposed Budker–type accelerator. Studies of corrosion mechanisms in boiler and reactor steels were continued with experiments designed to show the effects of FeOOH formation. (For preceding period see NP-6719.) (D.E.B.)

16634 PR-P-38

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

PHYSICS DIVISION PROGRESS REPORT [FOR] APRIL 1, 1958 TO JUNE 30, 1958. 74p. (AECL-673). $1.50(AECL).

Mechanisms for thermonuclear reactions in stars were investigated in an attempt to explain Cf^{254} production. The gamma branching ratio for Rb^{86} was measured as 8.7 ± 0.2%. Fission product mass distributions were obtained for U^{236}. Energy levels, spins, and parities are tabulated for O^{18}. Energies and intensities were measured for four gamma rays from the reaction $Mg^{26}(\alpha,n\gamma)$ Si^{29}. Excitation energies and excitation cross section ratios are tabulated for F^{19}, Na^{23}, Ti^{47}, and Mn^{55} excitation by He^3 and He^4. Calculations of gamma transition probabilities were carried out for excited levels in F^{18}. Neutron detectors were evaluated for their applicability to (p,n) threshold experimentation in tandem accelerators. Initial tests on the Chalk River tandem Van de Graaff accelerator are described. Gamma energies, spins, and parities were determined for levels in B^{11} resulting from the reaction $Li^7(\alpha,\gamma)$. An unusually abrupt decrease in cosmic radiation occurred on February 11, 1958. The variation as detected by three counters is tabulated. Neutron spectrometer and spectrometer data recording equipment developments are reviewed. Gamma energies are tabulated for (n,γ) reactions in Gd^{157}, Te^{123}, Ti, Mg^{25}, S^{33}, and P^{32}. Pressure effects on neutron scattering in liquid He were measured between 3.7 and 21.4 atmospheres. The new NRX control system was completely tested and put into regular use. Basic studies of transistor pulse amplifiers were continued. The convergence of the spherical harmonics approximation to the extrapolated end-point, Z_0, and the current-to-flux ration, $j(o)/e(o)$, in the Milne problem was examined. The results are given from neutron resonance absorption studies of an NRX natural U rod. Work was continued on the development of the mathematics for describing neutron spectra in the vicinity of absorbing slabs. The many-level formula was used in examining neutron resonances in Pu^{239}. The model of a nucleus obtained using a cut-off oscillator potential as a single particle single potential was improved by introducing separate potentials for neutrons and protons. (For preceding period see PR-P-37.) (D.E.B.)

16635 UCRL-8281

California. Univ., Berkeley. Radiation Lab.

PHYSICS DIVISION SEMIANNUAL REPORT [FOR] NOVEMBER 1957 THROUGH APRIL 1958. May 29, 1958. 67p. Contract W-7405-eng-48. $2.00(OTS).

Operational experience with the 15-in. bubble chamber is reviewed along with the assembly and initial testing of the 72-in. chamber. Work was continued on the analysis of K^- meson decay modes and the evaluation of K^- lifetime, on the study of Σ hyperon parity nonconservation, and on μ meson mass determinations. Beta decay energy spectra and lifetimes were determined for Li^8, Be^8, B^{12}, and N^{12}. The reaction $K^+ + n \rightarrow p^+ + K^0$ was used in studies of charge exchange for K^+. Nuclear emulsions were used in four fruitless attempts to detect Dirac unit magnetic poles. Meson(π^-) absorption and total cross sections were evaluated for Al, C, Cu, and Pb. Theoretical studies of mesons(π) interactions were continued. The arrangement of a coaxial velocity spectrometer for separating K^- and antiproton beams at the Bevatron is shown. An arrangement is proposed for detecting Λ antihyperons from the reaction $p + p \rightarrow \Lambda^0 + \bar{\Lambda}^0$. The neutron capture cross sections for lead at energies above 4 Bev were determined. The apparatus for producing a purified antiproton beam is described. The experimental arrangement for measuring recoil proton polarization in π^+–p scattering is presented. Cyclotron developments described include a range-changing capacitor, a probe–oscillating mechanism, a vacuum–gate mechanism, and an air–driven water door. (For preceding period see UCRL-8054.) (D.E.B.)

16636

NUCLEAR PHYSICS RESEARCH. H. J. Langmann. Atomwirtschaft 3, 331-2(1958) Aug.-Sept. (In German)

In the development of this field in the German Federal Republic, emphasis has been on the building of facilities. Some of the more important work is indicated. (J.S.R.)

16637

DECAY OF HEAVY HYPERFRAGMENT. P. L. Jain (Univ. of Buffalo). Can. J. Phys. 36, 1247-8(1958) Sept.

A partial analysis of an event which is interpreted as a non-mesonic decay of either a boron or carbon hyperfragment is given. (L.T.W.)

16638

INTERACTION OF 9 Bev PROTONS WITH FREE AND BOUND NUCLEONS IN EMULSIONS. N. P. Bogachev, S. A. Bunyatov, Yu. P. Merekov, and V. M. Sidorov (Joint Inst. of Nuclear Research). Doklady Akad. Nauk S.S.S.R. 121, 617-20(1958) Aug. 1. (In Russian)

One hundred fifteen similar (p-p) interactions and 63 similar (p-n) interactions were selected from 1308 incidents of proton interactions with nuclei in a 100-layer emulsion of ~450μ thickness and 10 × 10 cm area bombarded by 9-Bev protons. Considering the number of proton collisions with the quasi-free protons in the nucleus as equal to the number of collisions with quasi-free neutrons and excluding the incidents of elastic (p-p) scattering, it is possible to obtain the cross section of inelastic (p-p) interaction at 9 Bev as equal to ~30 mb. The cross section of inelastic (p-p) interaction does not vary in the range 1 to 9 Bev. The total of elastic and inelastic cross sections is equal to 40 mb. The angular distribution of fast charged particles in (p-p) and (p-n) incidents is identical. The mean free path for 9-Bev protons in photoemulsion is (37.1 ± 1.0) cm. The mean kinetic energy of fast particles inducing secondary interaction is 6 to 7 Bev for protons and 5 Bev for π mesons. Particles emitted at larger than 10° angle form stars with $n_s = 0.3 \pm 0.1$. (R.V.J.)

16639

THE EFFECT OF FLUCTUATIONS IN THE REACTION WIDTHS ON RESONANCE INTEGRALS. E. Kuhn and L. Dresner (Oak Ridge National Lab., Tenn.). J. Nuclear Energy 7, 69-70(1958) Aug.

An estimate of the resonance capture integral of non-fissile nuclei previously given has been corrected to include the effect of fluctuations in the neutron width. (auth)

16640

CORRELATIONS AND THE NUCLEAR MAGNETIC MOMENT. R. D. Amado (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 111, 548-58(1958) July 15.

Correlation structure can be introduced into the shell model by means of a product of pair correlation functions, each of which vanishes within the repulsive core radius and then approaches unity with a short range dependent only on the Fermi momentum and the relative energy of the pair. Correlations of this type are independent of the state of a particle within a given shell-model orbit. The additional effect of such scalar, state-independent correlations on the magnetic moment of a "closed shell plus one" nucleus is shown to vanish, leaving only the shell-model value. The proof can be extended to correlations having a scalar spin dependence and to certain more complicated symmetries. The effect of residual state-dependent correlations due to terms in the relative momentum of the correlated pair and to the space-exchange part of the attraction as it appears in the correlations is estimated for O^{17} as a correction to the magnetic moment of 0.002 magneton. There is no modification to the magnetic moment operator due to velocity dependence of the correlation functions, and the expectation value of the ordinary space exchange operator coming from the exchange part of the Hamiltonian is shown to be the same as given by the shell model. (auth)

16641

A MEASUREMENT OF THE SPIN CORRELATION COEFFICIENT C_{nn} IN p-p SCATTERING AT 382 Mev, FOR 90° CENTRE OF MASS SCATTERING ANGLE. A. Ashmore, A. N. Diddens, G. B. Huxtable, and K. Skarsvag (Univ. of Liverpool). Proc. Phys. Soc. (London) 72, 289-93(1958) Aug.

The experimental plan is described including a diagram of the apparatus. The measurement of C_{nn} was made in runs of 64 and 74 hours duration using a beam of about 1.4×10^9 protons sec^{-1} intercepting the target. The most important contribution was from p-p scattering events causing the operation of three counters which were set up on one side and only the first of three counters set up on the other side, with the asymetry in such measurements defined by the formula $e = RR + LL - LR - RL/RR + LL + LR + RL$; for a scattering angle of 90° in the center of mass it should be found that RR = LL and LR = RL. The value of asymmetry was $e = +0.192 \pm 0.035$. (J.R.D.)

16642

FORMULAS IN THE FERMI THEORY OF BETA-DECAY. I. BETA-SPECTRUM. Zyun-itiro Matumoto (Univ. of Tokyo) and Masami Yamada (National Research Council, Washington). Progr. Theoret. Phys. (Kyoto) 19, 285-329(1958) Mar.

β-spectra are calculated by assuming the Fermi theory. All the effects due to the finiteness of nuclear size are taken into account in an analytical form, and the screening effect by atomic electrons are included as additional factors though their values are not given explicitly. The electron wave functions are calculated and applied to get the correction factors for β-spectra. The mixed-type interaction consisting of scalar, tensor, and pseudoscalar is examined in detail. The final formulas are similar to those for light nuclei of Konopinski and Uhlenbeck. There is a difference, however, which lies in the fact that several "effective nuclear radii" are used in the formulas instead of the usual nuclear radius. Special attention is paid to the errors in the formulas, which seem to be inevitable from the practical viewpoint, and also to the insensitivity of the β-spectra to the nuclear charge distribution. (auth)

16643

NUCLEAR BINDING ENERGIES AND LOW-LYING ENERGY LEVELS IN THE $2s_{1/2}$ AND $1d_{5/2}$ SHELLS. Akito Arima (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 19, 421-50(1958) Apr.

On the basis of the jj-coupling shell model, the nuclear energies in the $2s_{1/2}$ and $1d_{5/2}$ shells are given by linear combinations of the parameters expressing the nuclear and Coulomb interaction energies in two-nucleon states, the single nucleon energies in $2s_{1/2}$ and $1d_{5/2}$ shells and the Coulomb interaction energies of a single proton in $2s_{1/2}$ and $1d_{5/2}$ shells with the closed shells. The best values of these parameters are determined by a least squares fit to the experimental binding energy data. The mean deviations are very small, and this shows the adequacy of the shell model in the ground states of these nuclei. By using these values of parameters the excitation energies are calculated, and it is shown that in some excited states configuration interactions seem to be important. The two-body force required to give the best fit with the interaction energies in two-nucleon states is discussed. (auth)

16644

THE ANTIPARTICLE. G. Wataghin (Univ. of Turin). Rend. seminar. mat. fis. Milano 27, 96-9(1957). (In Italian)

The fundamental properties of antiparticles are described and some conservation laws are discussed. A brief report of recent experimental results concerning anti-nucleons is given. (auth)

16645
ON THE STRUCTURE OF NUCLEAR SHELL 1 $f_{7/2}$. V. G. Neudachin. (2nd Scientific-Research Inst. of Physics.) Vestnik Moskov. Univ. 12, No. 2 111-16(1957). (In Russian)

The shell 1 $f_{7/2}$ between Ca^{40} and Ni^{58} was investigated in relation to the periodic system. (R.V.J.)

16646
PRODUCTION OF PHOTOSTAR AND FAST PROTON OR ANTIPROTON. A. S. Bushev and Yu. A. Vdovin (Moscow Inst. of Engineering Physics). Zhur. Eksptl'. i Teoret. Fiz. 34, 1652-3(1958) June. (In Russian)

The process of proton-antiproton pair production by high-energy γ quanta in which one particle of the pair is absorbed by the nucleus itself, forming a star, while the other particle carries away the total energy of the star is studied. The process takes place in the ultrarelativistic region where only the small angles between the γ quanta pulses and escaping proton (antiproton) are of great significance. An optical model is used to evaluate strong interactions of protons and antiprotons with nuclei. The nucleus is assumed to be an absolute blackbody of a given radius in relation to the proton and antiproton. (R.V.J.)

16647
NUCLEAR TECHNICS: PHYSICS, TECHNOLOGY, REACTORS. PART 5. Wolfgang Riezler and Wilhelm Walcher, eds. Stuttgart, B. G. Teubner Verlagsgesellschaft, 1958. pp. 641-800. (In German)

Part 5 continues the discussion of heat problems in reactors. Fundamental concepts in reactor control, research including a description of the various types, and power reactors are considered. In the discussion of power reactors, energy production in nuclear fission, construction of power reactors, and a survey of operating and planned reactors are discussed. (J.S.R.)

16648
NUCLEAR TECHNICS: PHYSICS, TECHNOLOGY, REACTORS. PART 6. Wolfgang Riezler and Wilhelm Walcher, eds. Stuttgart, B. G. Teubner Verlagsgesellschaft, 1958. pp. 801-960. (In German)

In this last section of the book, the discussion of power reactors is completed. Safety problems and analog calculators and simulators finish the section of reactors. A special chapter is included on controlled nuclear fusion. The final chapter is devoted to economic and legal problems of nuclear technology. (J.S.R.)

Nuclear Properties

16649 AECU-3806
Wisconsin. Univ., Madison.
THE FIRST EXCITED STATE OF B^{11} AND SPIN-FLIP STRIPPING. J. E. Bowcock. [1958.] 12p. Contract AT(11-1)-30. $3.30(ph OTS); $2.40(mf OTS).

The anomalous angular distribution in the $B^{10}(d,p)B^{11}$ reaction to the first excited state of the final nucleus is considered. The experimental distribution is characteristic of the orbital angular momentum of the captured neutron; however, the known spins and parities of the target and final state nuclei do not admit this value. By coupling the spin of the stripped proton to the spin of the target nucleus + neutron, an extra unit of angular momentum may be imparted to this system allowing the final state to be reached. The angular distribution from such a mechanism is calculated and fits rather well the experimental curves. (auth)

16650 AERE-N/R-1147
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE THERMAL NEUTRON CROSS SECTIONS OF Hf, Br, V, Se, Mo, AND Bi. P. A. Egelstaff. 1958. Date of MS. Apr. 16, 1953. Changed from OFFICIAL USE ONLY Sept. 8, 1958. 29p. $0.72(BIS).

The neutron total cross sections of Hf, Br, V, Se, Mo, and Bi were measured as a function of neutron energy between 0.001 ev and 0.10 ev. The measurements were analyzed to determine the absorption, total scattering, and coherent scattering cross sections. (auth)

16651
LIGHT ISOTOPES OF Te. M. Ya. Kuznetsova, V. N. Mekhedov, V. N. Rybakov, and V. A. Khalkin. Atomnaya Energ. 4, 583(1958). (In Russian)

Attempts are made to determine the mass number and life of tellurium isotopes with A < 118, according to the daughter products. The results showed $t_{1/2}$ for Te^{118} to be 2.5 hr, and for Te^{117} it is 1.7 hr. (R.V.J.)

16652
MEASUREMENT OF β-ACTIVITIES WITH AN END-WINDOW COUNTER. N. E. Tsvetaeva and M. N. Brusentsova. Atomnaya Energ. 4, 583-5(1958) June. (In Russian)

Measurements of β radiation absorption revealed the magnitudes $d_{1/2}$ for Ca^{45}, Co^{60}, P^{32}, RaE, S^{35}, and Tl^{204}. Correction coefficients for β absorption in 3 cm of air for Ca^{45}, Co^{60}, Cs^{137}, Nb^{95}, RaE, Rh^{106}, Sr^{90}, Tl^{204}, and Zr^{95} were used to determine the absolute β activity of Cs^{137}, $Sr^{90} \rightarrow Y^{90}$, Co^{60}. (R.V.J.)

16653
MEASUREMENTS OF ABSOLUTE PAIR PRODUCTION CROSS SECTIONS AT LOW ENERGIES. S. Standil and V. Shkolnik (Univ. of Manitoba, Winnipeg, Can.). Can. J. Phys. 36, 1154-60(1958) Sept.

Using an improved analysis in conjunction with a relative method for the measurement of absolute pair production cross sections, the pair production cross sections per atom of lead have been measured for the gamma rays emitted by Co^{60} and Sb^{124}. The Z-dependence of this cross section was measured for the Co^{60} radiation using targets of Al, Fe, Cu, Mo, Ag, Sn, and Pb. The results obtained are generally in agreement with other experimental determinations and are, along with those of other investigators, represented graphically. (auth)

16654
RESONANCE SCATTERING OF GAMMA-QUANTA ON Mg^{24} NUCLEI. N. N. Delyagin and V. S. Spinel. Doklady Akad. Nauk S.S.S.R. 121, 621-2(1958) Aug. 1. (In Russian)

Resonance γ scattering following the $Na^{24} \rightarrow Mg^{24}$ decay was studied in order to determine the lifetime of the first excited state of Mg^{24} at 1.37 Mev. (R.V.J.)

16655
NUCLEAR SPECTROSCOPIC INVESTIGATIONS OF THE RADIOACTIVE ISOTOPES Hg–Au^{195} AND Hg–Au^{193}. J. Brunner, J. Halter, and P. Scherrer. Helv. Phys. Acta 31, 335-78(1958). (In German)

The decays of Hg^{195} and Hg^{193} were investigated using β and γ spectroscopy and coincidence techniques. The resulting level schemes of Au^{195} and Au^{193} are compared with the predictions of the nuclear models (shell model and collective model). For most levels spin and parity are determined and proton configurations are derived from considerations based on the shell model. The

level schemes of Au^{197}, Au^{195}, and Au^{193} show remarkable analogies up to energies of ~1.5 Mev. (auth)

16656

ON THE THERMAL NEUTRON CAPTURE CROSS-SECTIONS. H. S. Hans and M. L. Sehgal (Muslim Univ., Aligarh, India). Indian J. Phys. 32, 276-80(1958) June.

Experimental and theoretical values of thermal neutron capture cross-sections were compared for a number of cases. An attempt is made to explain the discrepancy in many cases. It is proposed that in the case of Ag^{107}, Ni^{62}, In^{113}, Hg^{199}, Mo^{97}, and Hf^{179}, there exist negative energy levels close to zero energy. Radiation width in the case of Co^{59} is considered to be 0.6 ev, instead of 0.2 ev as given by Segre. (auth)

16657

INTERPRETATION OF DELAYED NEUTRON PHENOMENA. G. R. Keepin (Los Alamos Scientific Lab., N. Mex.). J. Nuclear Energy 7, 13-34(1958) Aug.

The Bohr-Wheeler mechanism of delayed neutron emission has been used, together with recent fission mass- and charge distribution data, to interpret the observed characteristics of delayed neutrons from fission. This interpretation accounts satisfactorily for recently measured periods and relative abundances of the delayed neutrons from six fissionable nuclides: U^{233}, U^{235}, U^{238}, Pu^{239}, Pu^{240}, and Th^{232}. A set of selection criteria is developed which lead to prediction of the most probable main precursors as well as possible contributors for each delayed neutron group. Assuming the most probable set of delayed neutron precursors, total delayed neutron yields have been calculated for each of the six fissionable nuclides studied. These calculated yields are in agreement with experiment, thus providing a reasonable explanation of the striking variation in observed total delayed neutron yields, which increase by an order of magnitude from Pu^{239} to Th^{232} fission. Throughout the analysis, special attention is given to the dominant role of closed-shell effects in delayed neutron systematics. (auth)

16658

ON THE CORRELATION OF THE NUCLEAR ENERGY LEVELS OF URANIUM-236 AND PLUTONIUM-240. P. A. Egelstaff (Atomic Energy Research Establishment, Harwell, Berks., Eng.). J. Nuclear Energy 7, 35-44(1958) Aug.

The current theoretical treatment of the energy levels excited in slow-neutron bombardment assumes that the level of excitation of the compound nucleus is so high that the parameters of the levels appear to be chosen at random. This assumption is supported by studies of parameters of individual resonances, but such studies can be made only over an energy region containing perhaps ten levels. A technique is developed by means of which this type of work may be extended over a region containing thousands of levels. This technique is then applied to the slow-neutron fission cross section of U^{235} and Pu^{239}, and the total cross section of U^{235}. It is found that there is strong evidence for a correlation existing over an energy range containing approximately sixty levels. A quantitative account of this correlation is worked out on the assumption that the cross section at any given point is partly determined by the local average cross section over an interval containing sixty levels. (auth)

16659

THE NUCLEAR MAGNETIC MOMENT OF PLUTONIUM-239. J. Butterworth (Atomic Energy Research Establishment, Harwell, Berks., Eng.). Phil. Mag. (8) 3, 1053-4(1958) Sept.

The nuclear magnetic resonance of Pu^{239} was sought with a nuclear magnetic induction spectrometer in the predicted range 0.2 to 0.6 nuclear magnetons. Failure to observe the resonance in this region may support a value of 0.02 nuclear magnetons previously reported from atomic beam resonance experiments. (D.E.B.)

16660

SPINS OF SOME RADIOACTIVE IODINE ISOTOPES. Hugh L. Garvin, Thomas M. Green, and Edgar Lipworth (Univ. of California, Berkeley). Phys. Rev. 111, 534-9(1958) July 15.

The spins of I^{123}, I^{124}, and I^{131} were measured by the method of atomic beams; the spins are $5/2$, 2, and $7/2$, respectively. The result $I = 7/2$ for I^{131} confirms an earlier measurement by a different method. (auth)

16661

DIRECTIONAL CORRELATION OF THE GAMMA RAYS IN Gd^{154}. G. D. Hickman and M. L. Wiedenbeck (Univ. of Michigan, Ann Arbor). Phys. Rev. 111, 539-47(1958) July 15.

Directional correlation measurements were carried out on five cascades involving the gamma rays in Gd^{154}. The results of these measurements in conjunction with the work of Juliano and Stephens, and Cork et al., show the existence of two rotational bands and possibly the start of two more such bands. The nature of these bands are explained in terms of the Bohr-Mottelson model for spheroidal nuclei. The levels are characterized by the quantum numbers (K, I, π) and are listed in order of increasing energy. The ground state rotational band consists of the ground state (0, 0, +) and the first and second excited states of (0, 2, +) and (0, 4, +), respectively. The 0.998-Mev and 1.130-Mev levels are assigned to a second rotational band with K = 2 and spin and parity values 2+, 3+, respectively. The assignment of quantum numbers to the 1.400-Mev level can be made as either (2, 2, ±) with the mixture of (99.5 ± 0.25% D, 0.5 ± 0.25% Q) for the 1.277-Mev gamma ray, or (3, 3, ±) with the mixture of (85 ± 2% D, 15 ± 2% Q) for the 1.277-Mev gamma ray. The state at 1.723 Mev is best characterized by the quantum numbers (2, 2, –) with the mixture of (99.7 ± 0.3% E1, 0.3 ± 0.3% M2) for the 0.725-Mev gamma ray, or (3, 3, –) with the mixture of (78.5 ± 6% E1, 21.5 ± 6% M2) for the 0.725-Mev gamma ray. (auth)

16662

DECAY OF COPPER-66. D. J. Horen and W. E. Meyerhof (Stanford Univ., Calif.). Phys. Rev. 111, 559-61(1958) July 15.

The decay of Cu^{66} (5.1 min) was reinvestigated by scintillation spectroscopy. A (0.83 ± 0.01)-Mev gamma ray was found to be in coincidence with the previously known 1.04-Mev gamma ray arising from the decay of the first excited state in Zn^{66}. This indicates a (second) excited state in Zn^{66} at 1.87 Mev in line with the level systematics of neighboring Zn isotopes. (auth)

16663

DECAY OF Tc^{97} GROUND STATE. Seymour Katcoff (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 111, 575-8(1958) July 15.

The half-life of the ground state of Tc^{97} was found to be $(2.6 \pm 0.4) \times 10^6$ years by comparison of its K x-ray intensity with that from the 90-day Tc^{97m} isomeric state. The L/K-capture ratio of Tc^{97} was compared with that of Tc^{96}; a somewhat larger ratio is indicated for the former. No γ rays were observed that could be attributed to Tc^{97}. The relation of these results to the occurrence of technetium in certain stars and to its possible occurrence in the earth's crust is discussed. Improved measurements

of the Tc^{98} γ-ray energies yielded values of 669 ± 5 kev and 769 ± 6 kev. (auth)

16664

GYROMAGNETIC RATIO OF THE 3.5×10^{-9} sec STATE AND OTHER ANGULAR CORRELATION MEASUREMENTS OF Tc^{99}. S. Raboy and V. E. Krohn (Argonne National Lab., Lemont, Ill.). Phys. Rev. 111, 579-80(1958) July 15.

The gyromagnetic ratio of the 181-kev state of Tc^{99} is found to be +1.5 ± 0.2 nuclear units. The angular correlation pattern obtained for the 740- and 181-kev pair of gamma rays is $W(\theta) = 1 + (0.067 \pm 0.004)P_2(\cos\theta) + (0.020 \pm 0.005)P_4(\cos\theta)$ and that of the 740- and 140-kev pair of gamma rays is $W(\theta) = 1 - (0.107 \pm 0.010) \times P_2(\cos\theta)$. (auth)

16665

GAMMA RAYS FROM Rb^{84m}. Leslie Cohen (U. S. Naval Research Lab., Washington). Phys. Rev. 111, 587-9(1958) July 15.

NaI(Tl) scintillators were used to study the gamma radiations from the isomer Rb^{84m}. The radiations were observed to consist of three components having energies of 216 ± 3 kev, 250 ± 3 kev, and 464 ± 3 kev. The half-life of the radiations, the intensities of the gamma rays, and the angular correlation between the 216-kev and the 250-kev radiations were measured. The measurements are consistent with the following assignments: the first excited state is located at 250 ± 3 kev and has J = 3+; the isomeric state is located at 464 ± 3 kev and has J = 6+. (auth)

16666

RADIOACTIVITY OF LEAD-205. J. Wing, C. M. Stevens, and J. R. Huizenga (Argonne National Lab., Lemont, Ill.). Phys. Rev. 111, 590-2(1958) July 15.

Pb^{205} was produced by the $Pb^{204}(n,\gamma)Pb^{205}$ reaction in the Materials Testing Reactor. The Pb^{205}/Pb^{204} atom ratios of 0.001175 ± 0.000060 and 0.005064 ± 0.000063, respectively, were measured in a mass spectrometer for lead samples irradiated in the MTR for approximately 3 months and 1 year. The neutron capture cross secton of Pb^{204} for MTR neutrons is 0.7 ± 0.2 barn. The partial half-life of Pb^{205} for L-electron capture is $(3.0 \pm 0.5) \times 10^7$ years. The K/L electron capture ratio of Pb^{205} is $\leq 6 \times 10^{-4}$, and the disintegration energy is probably less than 86 kev. No gamma rays were observed in the decay of Pb^{205}. (auth)

16667

ABSOLUTE MEASUREMENT OF (n,2n) CROSS SECTIONS AT 14.1 Mev. V. J. Ashby, H. C. Catron, L. L. Newkirk, and C. J. Taylor (Univ. of California, Livermore). Phys. Rev. 111, 616-21(1958) July 15.

Absolute (n,2n) cross sections were obtained by counting double-pulse events in a 240-gal cadmium-loaded liquid scintillator. The detection efficiency was determined experimentally using a spontaneous fission source and known values of $\bar{\nu}$. Conventional methods were used to measure the absolute neutron flux. Cross sections were measured for C, N, F, V, Fe, Cu, Ag, Ta, Cd, Au, Pb, Bi, D, and Be. The values in barns are: C, 0.006 ± 0.006; N, 0.019 ± 0.010; F, 0.062 ± 0.009; V, 0.66 ± 0.05; Fe, 0.50 ± 0.04; Cu, 0.76 ± 0.06; Ag, 1.73 ± 0.13; Ta, 2.64 ± 0.20; Cd, 1.92 ± 0.14; Au, 2.60 ± 0.20; Pb, 2.74 ± 0.20; Bi, 2.60 ± 0.19; D, 0.20 ± 0.02; Be, 0.54 ± 0.04. The (n,2n) cross sections for the last six elements are, within error, equal to the nonelastic cross sections. Nuclear temperatures were calculated. (auth)

16668

LOW LEVELS OF SOME NUCLEI IN THE $d_{\frac{5}{2}} - f_{\frac{7}{2}}$ SHELL. Sudhir P. Pandya (Physical Research Lab., Ahmedabad, India). Progr. Theoret. Phys. (Kyoto) 19, 404-6(1958) Apr.

Excitation energies of some low states of Cl^{35}, Ar^{37}, Cl^{39}, and K^{41} are calculated in the jj coupling scheme, independently of the details of the two-body nuclear interaction. Some pertinent experiments are suggested to check the calculations. (auth)

16669

NATURES OF NUCLEAR FORCE INDICATED BY THE PHOTODISINTEGRATION OF THE DEUTERON. III. S. H. Hsieh (Nagoya Univ., Japan). Progr. Theoret. Phys. (Kyoto) 19, 453-4(1958) Apr.

The d(γ,p)n reaction is investigated to determine the natures of nuclear force indicated by it. The sign of δ_1^2 is determined from the measurement of the total cross section of the d(γ,p)n reaction at $E_\gamma \simeq 10$ Mev. (W.D.M.)

16670

ENERGY LEVELS OF THE Dy^{161} NUCLEUS. S. A. Baranov, Yu. F. Rodionov, G. V. Shishkin, L. V. Christyakov. Zhur. Eksptl'. i Teoret. Fiz. 34, 1367-80 (1958) June. (In Russian)

The decay of beta-radioactive Tb^{161} was studied with a double focusing magnetic β spectrometer, a spectrometric proportional counter, and a scintillation spectrometer. The following γ transitions in the Dy^{161} nucleus were established on basis of the measurements: 25.6 (E1), 25.8 (E1), 27.7, 42, 48.9 (M1), 52, 57.6, 74.5 (E1), 103.8, 131.5 kev, and also less reliably established γ transitions with energies E_γ equal to 20.4, 23.1, 46.3, 53.2, 57.0, 78.3, 84.0, 1105.8, and ~275 kev. During investigation, groups of β-particles were detected which possess the following end point energies: $E_{\beta 1} = 540$ kev, $E_{\beta 2} = 465$ kev, $E_{\beta 3} = 415$ kev, and $E_{\beta 4} = 215$ kev. A feasible energy level scheme for the Dy^{161} nucleus is proposed on basis of the experimental results. (tr-auth)

16671

PHOTODISINTEGRATION OF Ar^{40}. I. P. Yavor (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 34, 1420-5(1958) June. (In Russian)

Photodisintegration of Ar^{40} nuclei induced by γ-bremsstrahlung of 70 Mev peak energy was investigated in a cloud chamber. The various types of photodisintegration as well as the integral cross section for the reaction (γ,p) were determined. The energy and angular distributions of photo-protons from argon were derived. (tr-auth)

16672

COLLECTIVE EXCITATIONS OF ODD NONSPHERICAL NUCLEI. A. S. Davydov and B. M. Murashkin (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 34, 1619-24 (1958) June. (In Russian)

A theory is developed for the energy states of odd nuclei corresponding to collective nucleon motion in which axial symmetry of the nucleus is not violated. It is shown that the spectrum of the energy states of the nucleus is determined by only two parameters. Conditions under which the energy state spectrum splits up into a system of rotational-vibrational bands are determined. (tr-auth)

16673

CALCULATIONS OF HALF LIFE OF Hf^{178} AND Hf^{180} IN EXCITED STATES. V. V. Anisovich (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 34, 1639-41(1958) June. (In Russian)

Calculations were made of Hf^{178} and Hf^{180} half lives with corrections of 7th order of smallness according to perturbation theory because the degree of K forbiddenness is equal to 7. (R.V.J.)

Nuclear Reactors

Refer also to abstracts 16184, 16186, 16187, 16225, and 16427.

16674 AECD-4258
Foster Wheeler Corp., New York.
SAFEGUARD REPORT—LIVERMORE POOL TYPE REACTOR. Robert L. Detterman, ed. 1956. Decl. Jan. 17, 1957. Includes Addendum, dated July 27, 1956. 118p. Contract AT(04-3)-70. (FW-56-006). $2.75 (OTS).

Radioactive effluents from the reactor are prevented from entering the external environment by enclosing the reactor in a steel building. Under certain meteorological conditions and following the improbable rupture of the reactor building, the surrounding off-site populations could be exposed to greater than the maximum permissible amounts of radioactive materials. The probability of such a catastrophic release of radioactive material has been kept to a minimum by the adequate safety considerations which have been incorporated in both the design of the reactor systems and the operating procedures for the facility. (auth)

16675 AECU-3659
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
STEAM EXPLOSIONS DURING A VIOLENT REACTOR TRANSIENT. Period covered: November 1, 1957 to February 1, 1958. W. E. Loewe and D. Krucoff. Feb. 13, 1958. Includes Appendix: THE ARK-I CODE. T. Englehart and W. E. Loewe. 34p. ARF Project No. D132A01. Contract AT(11-1)-528.

Analysis of the fission energy released during a nuclear runaway of a heterogeneous, water-moderated reactor is vital to an appreciation of the destructive capabilities of this type of reactor, and to intelligent design of a containment structure. The fission energy released in this type of reactor manifests itself, in a violent excursion, as a series of steam explosions. Generation of this series of explosions has been the subject of this study. The sources of steam explosions in heterogeneous, water-moderated nuclear reactors have been identified and analyzed. Three main types of steam explosion have been considered. These are prompt steam, delayed steam, and rupture steam explosions. (auth)

16676 AECU-3815
Atomic Power Development Associates, Inc., Detroit.
THE CRITICAL EXPERIMENT FOR THE ENRICO FERMI REACTOR. Technical Memorandum No. 15. E. L. Alexanderson. June 16, 1958. 22p. $4.80(ph OTS); $2.70(mf OTS).

As a part of the contract between the Atomic Energy Commission and Power Reactor Development Company, a critical experiment for the Enrico Fermi Reactor is to be carried out by Argonne National Laboratory. The experiment is to be done at the ZPR-III facility at the National Reactor Testing Station, Arco, Idaho. It is scheduled to start in July 1958, and continue for approximately one year. The principal objective of the experiment is to obtain the enrichment needed for criticality with a fixed reactor composition and geometry. Other objectives are given and a proposed program is outlined. (auth)

16677 AECU-3819
Massachusetts Inst. of Tech., Oak Ridge. Engineering Practice School.
REACTIVITY EFFECT OF APPR LOOP IN ORR. P. F. Palmedo, E. C. Hansen, and C. D. Koch. Mar. 20, 1958. 23p. For [Oak Ridge Gaseous Diffusion Plant. Contract W-7405-eng-26, Subcontract 70]. (KT-337). $4.80(ph OTS); $2.70(mf OTS).

The reactivity effects of inserting a test loop for testing Army Package Power Reactor components into the reflector of the Oak Ridge Research Reactor (ORR) are calculated for two possible accidents. One accident was flooding the loop with water, the other involved dropping a fuel element into the loop. For each, the K_{eff} was calculated on the IBM-704 using CURE program. Alternatively an effective δ k/k was calculated using two-group perturbation theory applied to a spherical approximation of ORR core geometry. It was concluded that neither of the accidents could produce a fast critical condition. (T.R.H.)

16678 AECU-3820
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
STUDIES OF REACTOR CONTAINMENT. Combined Monthly Progress and Financial Status Report No. 16. T. A. Zaker. Aug. 29, 1958. 6p. ARF Project No. D132. Contract AT(11-1)-528. $1.80(ph OTS); $1.80 (mf OTS).

Technical effort is briefly summarized on blast shielding, reactor containment, and blast effects studies. (For preceding period see M-6676.) (T.R.H.)

16679 AERE-R/R-2569
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE INTERPRETATION OF FINE STRUCTURE MEASUREMENTS. PART III. GRAPHITE–URANIUM LATTICES. I. S. Grant and J. E. C. Mills. 1958. 17p. (NPCC/RPWP/P-122).

Fine structure thermal neutron distributions across lattice cells of different pitches, with varying sizes and fuel enrichments and with varying coolant channel diameters, are analyzed in terms of nuclear parameters by means of simple diffusion theory formulas. The trends observed are expressed in terms of linear formulas. (auth)

16680 AERE-R/R-2602
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
EXPONENTIAL EXPERIMENTS FOR P.I.P.P.A. MK. I. G. Bevan, P. W. Mummery, A. J. Salmon, and M. W. Thompson. 1958. MS. Date Nov. 1954. Decl. June 1958. 76p. $2.70(BIS).

Declassified version of AERE-RP/R-1545.

A series of exponential experiments were performed which were designed to provide criticality data for PIPPA Mark I and to systematically increase the amount of criticality data for gas-cooled graphite-moderated uranium reactors in general. The experimental methods used and the method of analysis of the observations are described in detail. Tables of experimental observations are given together with the values of the Laplacian and the migration area asymmetry deduced from the analysis. (auth)

16681 AERE-T/R-103
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE EFFECT OF HOLES IN A REACTING MATERIAL ON THE PASSAGE OF NEUTRONS, WITH SPECIAL REFERENCE TO THE CRITICAL DIMENSIONS OF A

REACTOR. D. J. Behrens. 1958. Date of MS. [1947?]. Decl. July 1954. 9p. $0.45(BIS).

The increase in the migration length of neutrons in a reactor caused by the presence of holes in the reactor is discussed. This effect can be evaluated in terms of a simple geometric function of the shape of the holes, and in addition to a variation as the inverse over-all density of the material in the reactor, the migration length also contains a term which depends upon the size of each hole. When the hydraulic radius of the hole becomes comparable to the mean free path of neutrons in the reactor material, the last term becomes dominant, and it is therefore desirable that all holes be kept as small as possible. Holes which are totally enclosed, or which contain a unidirectional infinity all give results of the same order of magnitude, but anything in the nature of a two-dimensional plane gash, cut through the middle of the reactor, leads to a theoretically infinite increase in the migration length, and hence to a serious escape of spare neutrons. It is concluded that no holes in a reactor should contain a more than unidirectional infinity, and that they should be kept as small as possible. (auth)

16682 APAE-29
Alco Products, Inc., Schenectady, N. Y.
CORROSION PRODUCT ACTIVITY IN THE PRIMARY SYSTEM OF THE ARMY PACKAGE POWER REACTOR. Apr. 15, 1958. 73p. Contract AT(11-1)-318.

Experimental work has been performed to determine the extent and mechanism of the buildup of activated corrosion products in the primary system of the Army Package Power Reactor. The results of radiochemical analyses of water and crud sampled from the primary system, and of deposits removed from the surface of metal test specimens exposed to the primary coolant are presented. In addition, the dose rates measured during reactor shutdown at the external surfaces of primary system components are reported. Water, crud, and deposits from the metal test samples were analyzed for long-lived gamma emitting nuclides only. Data are presented on the specific activity of these samples and the nuclide ratios of these specific activities. The buildup of activity on the surface of the metal specimens is shown to be related to time of exposure, temperature of the coolant, and the type of steel specimen used. (auth)

16683 APAE-Memo-93
Alco Products, Inc., Schenectady, N. Y.
FUNDAMENTAL CONCEPT OF VAPOR CONTAINMENT ON APPR-1A. Kenneth Kasschau. Mar. 15, 1957. 17p. Contract DA-95-507-eng-940(neg).

An attempt is made to reduce the complex rationalization of the various factors involved in the vapor container for APPR-1A to the fundamental points involved in the processes of defining and designing the containment system. (W.D.M.)

16684 BMI-1269
Battelle Memorial Inst., Columbus, Ohio.
SIMULATION OF VARIOUS ACCIDENT CONSIDERATIONS FOR A MERCHANT-SHIP PRESSURIZED-WATER REACTOR. Roger S. Boyd, Benjamin B. Gordon, Richard H. Byers, Leon E. Winslow, and J. James Stone, Jr. Aug. 25, 1958. 71p. Contract W-7405-eng-92. $2.00(OTS).

A study was conducted on the safety aspects of foreseeable accident types in connection with the Nuclear Merchant Ship Reactor program. Four accidents have been selected for analysis by analog simulation techniques: continuous rod withdrawal, startup, loss of coolant flow, and cold-water insertion. The simulation of the reactor only was required for these situations because the effects of the accidents would be completed in less than one primary-coolant loop time. The external control system was ignored, and only the effects of the negative reactivity coefficients were considered in the natural shutdown of the plant. Three phases of operation were considered in these analyses: operation with no safety system, high-flux scram, and period scram. The programs involved the variations of the scram parameters and the reactor temperature coefficients over the range of possible values for this reactor power plant. Results indicate that the inherent stability of the reactor system is sufficient to attenuate the power excursions resulting from the first three accidents. In the cold-water accident, if the difference in loop temperatures is on the order of 300°F, scram is necessary to limit the power excursion. (auth)

16685 CF-54-8-233
Oak Ridge School of Reactor Technology, Tenn.
MTR CONVERTER WITH AQUEOUS BLANKET. A. L. Lindsay, B. L. Byrum, W. R. Clendinning, R. F. Fraley, K. H. Hall, T. S. Moy, J. F. Schonberger, and J. P. Simpelaar. Aug. 1954. Decl. Nov. 15, 1957. 187p. $28.80(ph OTS); $8.40(mf OTS).

Reactors employing two different arrangements of the aluminum-clad MTR-type fuel elements and an aqueous solution "blanket" are considered for the production of low g/t plutonium. A heterogeneous type arrangement appears to be the preferable one. Of the several methods of plutonium removal considered, a plutonium precipitation method is to be preferred although this method must be developed further. (auth)

16686 CF-58-4-8
Oak Ridge National Lab., Tenn.
HRT STEAM SYSTEM FEEDWATER PRESSURE CONTROL. H. D. Wills. Apr. 15, 1958. 12p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

A frequency response analysis in which system response to sinusoidal perturbations is considered and theorems permit conclusions regarding stability and transient response has been made for the Homogeneous Reactor Test steam system feedwater pressure control system. The analysis indicates that this system will operate satisfactorily at 1000 psi with controller settings as follows: sensitivity—~4 psi per inch; reset rate—~5 repeats per minute. (auth)

16687 CF-58-7-72
Oak Ridge National Lab., Tenn.
SPECIFICATIONS AND FABRICATION PROCEDURES FOR APPR-1 CORE II STATIONARY FUEL ELEMENTS. J. E. Cunningham and R. J. Beaver. July 15, 1958. 77p. Contract W-7405-eng-26. $12.30(ph OTS); $4.50(mf OTS).

Stainless steel-base fuel components of thin plate-type construction and containing a dispersion of enriched UO_2 have been successfully employed in powering the Army Package Power Reactor. The stationary fuel component proposed for operation in the second core loading of the reactor is discussed. The component is designed for radioactive service in pressurized water at 450°F and consists of eighteen composite fuel plates joined into an integral unit or assembly by brazing. Design specifications covering the material and dimensional requirements as well as the operating conditions are discussed. Step-by-step procedures developed and utilized in manufacturing the component are presented in detail. (auth)

16688 IDO-16461
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
HEAT TRANSFER IN THE ETR. V. A. Walker. Aug. 27, 1958. 12p. Contract AT(10-1)-205. $0.50(OTS).

Text of a paper presented at the American Nuclear Society Meeting held in Los Angeles, Calif., June 2, 3, 4, and 5, 1958.

This report was issued May 16, 1958 as PTR-307.

A critical review of the heat transfer in the ETR fuel elements was undertaken to establish the reactor operating parameters. The basic criterion was that the calculated maximum wall temperature in the hot channel be less than or equal to the saturation temperature at the hot spot pressure. The hot spot and hot channel factors are based on actual measurements made with the Mark IV fuel elements; the hot spot and hot channel factors are reported. A standard ETR fuel assembly was modified by the substitution of an oversized fuel plate (0.370 in. thick) for three standard plates. Thermocouples were inserted in the cladding of the oversized plate. This instrumented fuel plate was operated at different conditions to determine the coolant requirements immediately following a loss of flow accident, the effect of channel blockage, the extent of natural circulation in the primary coolant system, and the amount of heat that could be removed by natural convection currents within the reactor vessel only. Film boiling was found when operating at the following conditions:

Channel Velocity ft/sec	Maximum Heat Flux Btu/hr, ft^2	Inlet Water Temp., °F	Operating Pressure
0.6	48,000	130	150
0.8	85,000	130	150

With a coolant velocity of 0.9 ft/sec film boiling was not evident at a heat flux of 94,000 Btu/hr, ft^2. Film boiling was not observed even when the entrance to the instrumented channel was 90% blocked and the water velocity was 0.9 ft/sec. There was no natural circulation in the system while operating with only one heat exchanger bank. Natural convection cooling within the reactor vessel successfully cooled at a maximum heat flux of 30,000 Btu/hr, ft^2. (auth)

16689 IGO-AR-42
United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.
ACCIDENT TO NO. 5 TURBO-GENERATOR AT CALDER HALL POWER STATION ON JUNE 28, 1958. Report of the Board of Enquiry. 30p.

The coincident failure of the H.P. governor valve and H.P. runaway stop valve to close automatically caused the No. 5 turbo-generator of Calder B to overspeed and ultimately to disintegrate. The foreign bodies causing the jamming of the valves were determined to be fragments of chilled iron shot carried into the valves by the steam system. Recommendations to avoid future accidents are given. (W.D.M.)

16690 IP-199
Michigan. Univ., Ann Arbor. Coll. of Engineering.
NUCLEAR POWERED GAS TURBINES FOR LIGHT-WEIGHT POWER PLANTS. Frederick G. Hammitt and Harold A. Ohlgren. Jan. 1957. 57p.

The suitability of closed-cycle gas turbine power plants in combination with various types of nuclear reactors is examined. Typical examples of both a heterogeneous and a homogeneous reactor power plant are presented. Weight, cost, and performance are compared for various possible fluids over a range of temperature and pressure. Comparisons are made with alternative heat engine systems. (auth)

16691 KAPL-2000-2
Knolls Atomic Power Lab., Schenectady, N. Y.
REACTOR TECHNOLOGY QUARTERLY REPORT NO. 5. ENGINEERING. Apr. 1958. 106p. Contract W-31-109-Eng-52. $2.25(OTS).

Tests were performed to establish the adequacy of the pressure vessel closure head design and to provide general information for the design of perforated plates subjected to transverse pressure loads. Two tests are reported. The first test was made with an Al plate and was intended to demonstrate the feasibility of attempting to extend Harvy's theory to plates whose depth was large with respect to the radius and where the number of penetrations was relatively small. The second test was made with a 3/8-scale model of the reactor pressure vessel and the reactor pressure vessel head. A discussion is presented of the dynamic simulation of high-temperature high-pressure water. An air flow testing technique involving the chemical reaction of H_2S on copper was used to confirm qualitatively variations in local heat transfer coefficients on large-scale cross-section twisted ribbons. A discussion is presented on velocity depression due to the wall bounding a matrix of reactor fuel elements. A method was developed for analyzing the response to mechanical shock of components mounted on a reactor pressure vessel. A method of calculation of frequencies and mode shapes for multi-degree of freedom systems using the IBM-650-computer is presented. The design and testing of values is presented. The cyclic growth in pressure vessels is discussed. The stress corrosion characteristics of hardened type 410 stainless steel are presented. A decontamination test was carried out at the KAPL-120 loop at Hanford. Results are presented. The use of transistorized trip circuit for monitoring and safety circuits for critical assemblies is discussed. A neutron-sensitive thermocouple for instantaneously measuring neutron flux distribution in a reactor core is being developed. (For preceding period see KAPL-2000-1.) (W.L.H.)

16692 NAA-SR-1879
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
ECONOMIC ANALYSIS OF AN OMR-POWERED 38,000-DWT TANKER. Mar. 18, 1957. 17p. Contract AT-11-1-GEN-8. $0.75(OTS).

NAA-SR-1851, with supplement, and NAA-SR-1880 present information related to this report.

This economic survey was prepared in order to arrive at an average cost for transporting oil in bulk on a 38,000-dead weight ton freighter with an organic moderated nuclear propulsion plant from Kuwait in the Persian Gulf to Philadelphia and to compare these costs with those for a conventionally powered tanker. (W.D.M.)

16693 NAA-SR-Memo-1004
North American Aviation, Inc., [Downey, Calif.].
ANALYSIS OF THERMAL FLUX MEASUREMENTS IN THE SEVEN ROD CLUSTER EXPERIMENT. F. L. Fillmore. May 18, 1954. Decl. Oct. 14, 1955. 12p. Project No. 1102. $3.30(ph OTS); $2.40(mf OTS).

The thermal flux and disadvantage factors for the seven-rod cluster were calculated using elementary diffusion theory and a cylinderized model. Since it is known that diffusion theory doesn't give the correct answer to this problem, it is believed that the model chosen provides a reasonable framework for the lattice cell calculations relating to the seven-rod cluster. A compari-

son is made between the observed and theoretical values of the thermal flux. (W.D.M.)

16694 ORNL-2348
Oak Ridge National Lab., Tenn.
COMPONENTS OF THE FUSED-SALT AND SODIUM CIRCUITS OF THE AIRCRAFT REACTOR EXPERIMENT. H. W. Savage, G. D. Whitman, W. B. McDonald, and W. G. Cobb. Sept. 18, 1958. 43p. Contract W-7405-eng-26. $1.25(OTS).

The Aircraft Reactor Experiment (ARE) successfully demonstrated the feasibility of generating heat by fission in a fused-fluoride circulating fuel. Most of the heat was removed from the reactor by the fused fluoride at 1580°F. Sodium at 1350°F was used to cool the BeO moderator. With minor exceptions all the components proved to be adequate. The development of components and fabrication techniques for this reactor consumed a four-year period, during which time the technology for handling high-temperature fluids was extended to equipment operable above 1500°F. The methods used for determining compatibility of materials under static and dynamic conditions, standards for materials, and techniques for welding, fabrication, and assembly and the design criteria for pumps, seals, valves, heat exchangers, cold traps, expansion tanks, instrumentation, preheating devices, insulation, etc., are described. (auth)

16695 ORNL-2551
Oak Ridge National Lab., Tenn.
MOLTEN-SALT REACTOR PROGRAM QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JUNE 30, 1958. Sept. 24, 1958. 115p. Contract W-7405-eng-26. $2.75(OTS).

Reactor Design Studies. A conceptual design of a two-region, fluid-fuel power reactor, 640 Mwh and 260 Mwe, was prepared and evaluated for fabricability. Design work for the reactor fuel pump was completed. Nuclear calculations were continued with studies of Pu^{239} and U^{233} fuels. Studies of various cover gases indicate only argon and helium are suitable. Test rigs were designed for experimental studies of bearings for molten salt applications. Some preliminary results are given on both bearings and lubricants. Test of mechanical joints for remote separation of fused salt system components were continued. None of the joints tested gave evidence of leakage. Data from heat transfer coefficient tests on $BeF_2-LiF-UF_4$ systems are presented. Physical property measurements were made on $BeF_2-LiF-UF_4$ and $BeF_2-NaF-UF_4$ systems. A conceptual design was prepared of a 5 Mw experimental reactor in which molten salt fuel would be circulated by thermal convection. The heat exchanger equipment required for gas cooling a molten-salt reactor was studied. Materials Studies. Metallurgical examinations and corrosion evaluations were made of specimens of several Inconel and INOR-8 thermal-convection loops in which various fluoride mixtures had been circulated. Specimens of Inconel and INOR-8 exposed to a sodium-graphite system were examined for carburization effects to their physical properties. Brazing alloys with high gold and silver contents show promising corrosion resistance to molten salts. Additional tests indicate the weldability of INOR-8 is satisfactory. INOR-8 and Inconel capsules were fabricated for testing the stability of graphite in contact with molten-salt fuels. Phase equilibrium studies of BeF_2-LiF systems containing UF_4 and/or ThF_4 were continued. Data were obtained on the solubility of PuF_3, NiF_2, noble gases, and various fission products in alkali fluoride-beryllium fluoride systems. The chemical reactions of BeO with fluoride melts were investigated. Data are also presented on Cr diffusion in Ni-base alloys and $CrF-BeF_2$ vapor pressures. (For preceding period see ORNL-2474.) (D.E.B.)

16696 SRI-1
Stanford Research Inst. Poulter Labs., Menlo Park, Calif.
CONTAINMENT OF FRAGMENTS FROM RUNAWAY REACTOR. Technical Report No. 1. N. R. Zabel. Apr. 2, 1958. 93p. SRI Project No. GU-2164. Contract AT(04-3)-115, Modification No. 2. $2.50(OTS).

The problem of rupture of the outer vapor container by fragments from a runaway reactor was investigated. The results of a detailed theoretical and experimental examination of the process of penetration of a plate by a rod are presented. Outlines of the problems associated with nuclear reactor excursion are discussed along with the applicable large deformation theory and a theoretical method for calculating the energy of deformation. The projectile launching devices are described, and the experimental data from semistatic puncturing tests, tensile tests of target material, and kinetic penetration experiments are tabulated. (J.R.D.)

16697 VAL-41
General Electric Co. Vallecitos Atomic Lab., Pleasanton, Calif.
NON-LINEAR REACTOR STABILITY. G. W. Stuart. Nov. 15, 1957. 9p. $1.80(ph OTS); $1.80(mf OTS).

A theorem is developed relating non-linear reactor stability to linear reactor stability. (auth)

16698 WAPD-BT-8
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. June 1958. 159p. Contract AT-11-1-GEN-14 and appropriate NObs-Contracts. $3.00(OTS).

Twenty-one papers are included. Separate abstracts are prepared for each paper. (D.E.B.)

16699 WAPD-BT-8(p.1-18)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
CONVERSION RATIO AND ITS TIME DEPENDENCE IN A SIMPLE SEED-BLANKET GEOMETRY. J. M. Tanner. p.1-18 [of] BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 18p.

The spatial and time variation of plutonium buildup affects the lifetime of a seed-blanket core and is, therefore, of primary design importance. To study these combined effects, a "conversion ratio" for this U^{235} and Pu^{239} buildup is mathematically defined and is investigated for a simple slab geometry in both the homogeneous and heterogeneous forms. Results indicated that this conversion ratio can predict behavior in the heterogeneous model rather closely and that, while a homogenization of this model can only predict a good average of the spatial distribution, its time variation predictions agree very well with the heterogeneous predictions. (auth)

16700 WAPD-BT-8(p.19-21)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
CALCULATION OF BUILDUP FACTORS FOR INFINITE PLANE AND LINE SOURCES. D. C. Anderson. p.19-21 [of] BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 3p.

Although in a typical shield design the radiation sources are finite in extent, available tabulated buildup data are provided only for ideal source geometries such as point isotropic and plane monodirectional. This article provides tabulations of the buildup factors in infinite

homogeneous media for infinite isotropic plane and line sources. Ready information is made available to the designer as to the effect of source geometry on the magnitude of the buildup factor. (auth)

16701 WAPD-BT-8(p.22-5)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
COMPARISON OF PEEBLES' BUILDUP DATA TO EXPERIMENT AND MOMENTS METHOD RESULTS.
D. C. Anderson. p.22-5 [of] BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 4p.

Estimates of slant penetration effects are of importance in a detailed shield design. This article examines the application of Peebles' data in obtaining slant penetration estimates and compares the results with experimental data. Results indicate that the use of Peebles' calculations is preferable for problems in which slant penetration for angles greater than 45° becomes important. (auth)

16702 WAPD-BT-8(p.26-38)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SYNTHESIS METHODS IN R-Z GEOMETRY. R. B. Horst. p.26-38 [of] BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 13p.

A reasonably accurate method of synthesizing three-dimensional power distributions from one- and two-dimensional solutions is useful in nuclear design studies since three-dimensional solutions are costly and time-consuming. Techniques for such synthesizing are examined, and a comparison is made between the exact solution for the special case of symmetry in the variable θ and the synthesized solutions. Although results of both synthesis from a core average traverse and from a point of traverse are good, the results from the former appear slightly better because they are more conservative. (auth)

16703 WAPD-BT-8(p.39-45)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SYNTHESIS OF LIFETIME POWER DISTRIBUTION IN R-Z GEOMETRY. T. W. Ball. p.39-45 [of] BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 7p.

The synthesized point traverse (SPOT) approach to solving a three-dimensional, lifetime power distribution problem is compared with an exact solution. The four steps required in the synthesis are described and discussed. Results show that there is reasonable agreement between the curve shapes and the normalizations, and preliminary investigation indicates that synthesis to other radial positions should also be good. (auth)

16704 WAPD-BT-8(p.46-52)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SYNTHESIS OF THREE-DIMENSIONAL POWER SHAPES—APPLICATION OF FLUX-WEIGHTED SYNTHESIS TECHNIQUE. W. N. Lorentz. p.46-52 [of] BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 7p.

The problem of synthesizing three-dimensional power shapes is somewhat complex due to the interrelationship of factors which change throughout core lifetime. A three-dimensional flux-weighted synthesis model was developed which takes this interrelation into account. This article describes the application of the model to a typical highly-enriched pressurized water reactor experiment and shows that reasonably good agreement is obtainable between predicted and experimental results. (auth)

16705 WAPD-BT-8(p.53-7)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
EMPIRICAL DETERMINATION OF THE FAST-ABSORPTION CONSTANT FOR HAFNIUM CONTROL RODS. L. L. Jones, Jr. p.53-7 [of] BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 5p.

To solve neutron diffusion problems in the x-y geometry, it is necessary to obtain appropriate diffusion theory constants for each region. An accurate constant for hafnium, which properly reflects the epithermal effects, is difficult to obtain. An empirical method for determining the effective absorption cross section for hafnium is described. (auth)

16706 WAPD-BT-8(p.58-61)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
FAST ABSORPTION OF HAFNIUM AND CADMIUM–SILVER CONTROL RODS. R. J. Neuhold. p.58-61 [of] BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 4p.

Fast absorption calculations were made for a highly enriched, many-rodded, approximately cylindrical core using Cd-Ag and Hf control rods and a two-dimensional diffusion theory code (PDQ). Axial bucklings in both the rodded and unrodded core sections were measured for each of the two types of rods, and several two-group PDQ problems were solved in the rodded section to obtain a plot of the eigenvalue versus Σ_a^f. These plots, which were obtained for control rods operating in a bank, have proven effective in two-dimensional shutdown analyses, rod programmed configurations associated with this core, and one-dimensional, two-group control rod analyses. (auth)

16707 WAPD-BT-8(p.62-6)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
HAFNIUM CONTROLLED CRITICAL ASSEMBLY.
R. S. Halgas. p.62-6 [of] BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 5p.

A critical assembly controlled by a hafnium sheet was constructed as part of the over-all Bettis program to develop methods for analyzing control rod effect. Experimental information obtained is compared with theoretical calculations. The effect of hafnium has been estimated in a four-group calculation and a comparison of experimental and theoretical flux distributions is given. (auth)

16708 WAPD-BT-8(p.67-72)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
ANALYSIS OF SLIGHTLY ENRICHED URANIUM–WATER LATTICES. S. Stein, S. J. Lukasik, and R. L. Hellens. p.67-72 [of] BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 6p.

In 1953, a broad experimental program to study high uranium-content reactors in exponential and critical assemblies was undertaken jointly by Bettis Plant and the Brookhaven National Laboratory. A brief account is given here of the theoretical analysis of the critical properties of such systems. Some of the Bettis experimental results are set forth. (auth)

16709 WAPD-BT-8(p.73-9)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
CRITICAL EXPERIMENTS ON WATER-MODERATED LATTICES OF SLIGHTLY ENRICHED URANIUM DIOXIDE (UO_2) FUEL RODS. J. R. Brown. p.73-9 [of] BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 7p.

Critical assembly measurements were made to investigate some of the parameters of water-moderated lattices of slightly enriched UO_2 fuel rods. Measurements of buckling, reflector savings, temperature coefficient of reactivity, buckling coefficient of reactivity and anisotropy were made on eight lattices of varying H_2O

ratio, UO_2 density, and fuel diameter. The experimental methods used and the results obtained are presented and the errors discussed. (auth)

16710 WAPD-BT-8(p.80-3)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE MEASUREMENT OF PARAMETERS IN HIGH URANIUM CONTENT LATTICES. D. Klein and G. Smith. p.80-3 [of] BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 4p.

The thermal utilization, resonance escape probability, and fast effect were measured for 1.3% enriched U- and UO_2-fueled lattices. Experiments carried out at TRX are described, and some of the basic mathematical expressions and relations employed are set forth. With a few explained exceptions, results generally support calculations. (auth)

16711 WAPD-BT-8(p.84-9)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
CRITICALITY CALCULATIONS FOR THE TRX. R. B. Horst. p.84-9 [of] BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 6p.

The high U^{238} content of slightly enriched, water-moderated reactors makes the theoretical prediction of criticality difficult. Seven slightly enriched clean critical assemblies were constructed and their nuclear characteristics were measured and compared with those calculated for a theoretical, high U^{238} content core. While the design of a power reactor would introduce more complex problems, the agreement between the reactivity characteristics of the model and the seven critical assemblies obtained in these experiments is good and the model described herein should be useful in establishing reactivity characteristics of future cores of this type. (auth)

16712 WAPD-BT-8(p.90-103)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
TECHNIQUES OF REACTIVITY MEASUREMENT. G. R. Hopkins and C. P. Jamieson. p.90-103 [of] BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 14p.

The Reactivity Measurement Facility (RMF) used in conjunction with the Materials Testing Reactor (MTR) is a powerful research tool. With sufficient care, the reactivity worths of samples can be obtained quickly and accurately, and the fuel and/or poison content of the samples can be determined by comparison of the samples with appropriate standards. Complications in this non-destructive type of analysis and techniques for over-coming these complications are discussed; the discussion of two experiments performed using the RMF illustrates both the difficulties and the potentialities of the RMF as a research tool. (auth)

16713 WAPD-BT-8(p.104-14)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PILE IRRADIATION OF FUEL-BEARING PLASTIC TAPES. E. R. Sanford and P. N. DeAgazio. p.104-14 [of] BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 11p.

A method for providing safe self-shutdown of low temperature critical assemblies is through the mechanism of plastic fuel tape expansion during flux transients. Experimental determination of some of the expansion properties of tapes by pre-post irradiation measurements is reported, and the effects of integrated thermal neutron flux exposure, static external pressure, fuel loading, flux level, and cross-linking are discussed. Although the dynamics of the expansion are not directly known, it is concluded that fuel tape expansion in water-moderated critical assemblies can eject moderator at a rate sufficient to safely limit accidental transients. (auth)

16714 WAPD-BT-8(p.115-20)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
CRITICALITY EXPERIMENTS USING MINIATURE FISSION COUNTERS. L. A. Mikoleit. p.115-20 [of] BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 6p.

A miniature fission counter, designed at Bettis, has proved to be a valuable and accurate tool for measuring flux distributions in restricted areas of experimental critical assemblies. A general description of the device is given along with some of its uses to date. Some possible future applications are proposed. (auth)

16715 WAPD-BT-8(p.121-4)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
ELECTRON MULTIPLIER NEUTRON DETECTORS. L. Daum. p.121-4 [of] BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 4p.

This paper was previously abstracted and appears in NSA, Vol. 12 as abstract No. 15735.

16716 WAPD-BT-8(p.125-33)
Westinghouse Electric Corp. Research Labs., East Pittsburgh, Penna.
TRANSISTOR LOGIC APPLIED TO DIGITAL PRESSURE CONTROL AND INDICATION. W. M. Kaufman and T. A. Jeeves. p.125-33 [of] BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 9p.

A model of a digital pressure control device was built utilizing only transistor NOR elements in the logic circuitry. The device incorporates a recently developed electroluminescent display panel for readout. The system operation and the details of the circuitry are described. (auth)

16717 WAPD-BT-8(p.134-6)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SIMULATION OF HOT CHANNEL BOILING. S. O. Johnson. p.134-6 [of] BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 3p.

The transient thermal behavior of a reactor hot channel has been simulated including the effects of boiling of the coolant. The methods used to mathematically represent the conductive and convective heat transfer involved are briefly described. A typical response to a loss-of-coolant-flow transient with delayed scram is presented. (auth)

16718 WAPD-BT-8(p.137-47)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
A METHOD OF EVALUATING HEAT TRANSFER SIMULATION IN PRESSURIZED WATER REACTORS. R. P. Rose and S. O. Johnson. p.137-47 [of] BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 11p. (WAPD-T-542).

Also issued separately as WAPD-T-542 and previously abstracted in NSA, Vol 12, abstract No. 1656. (D.E.B.)

16719 WAPD-BT-8(p.148-51)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
ON THE EQUIVALENCE OF THE SPHERICAL HARMONICS METHOD AND THE DISCRETE ORDINATE METHOD USING GAUSS QUADRATURE FOR THE BOLTZMANN EQUATION. R[obert] Gast. p.148-51 [of] BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 4p. $0.75(OTS).

This is a condensation of WAPD-TM-118 abstracted for NSA Vol. 12, Abstract No. 16556.

16720 WAPD-IPC-772
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
PROSPECTUS FOR IRRADIATIONS IN THE NRU J-16 LOOP. D. E. Thomas, R. H. Fillnow, and S. B. McRickard. [Dec. 1957.] Decl. Jan. 3, 1958. 26p. $4.80(ph OTS); $2.70(mf OTS).

Previous irradiation tests on gamma-phase U–Nb indicate that irradiation experiments should be conducted with a wider range of compositions containing Zr which improves corrosion and radiation behavior. A new specimen design is described for use in the in-pile loop. Other equipment designs, test conditions, and procedures are described. (T.R.H.)

16721 WAPD-PC-156
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
PWR SIMULATOR PROGRAM. Grady L. Hartfield, Andre R. Barbeau, and Thomas J. Walker. May 9, 1955. 19p. $3.30(ph OTS); $2.40(mf OTS).

The equations to be used in the PWR simulator program are presented, including computations for power and temperature control tests, xenon transients, combination–load and xenon transients, and start-up studies. The approximations for the pressurizer in this set of runs are listed, and the conditions to be used are presented. (J.R.D.)

16722 WAPD-TH-38
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
THE CALCULATION OF HOT CHANNEL FACTORS FOR PARALLEL FLOW ROD SUBASSEMBLIES. B. W. Le Tourneau and R. E. Grimble. Mar. 7, 1955. Decl. July 10, 1958. 7p. $1.80(ph OTS); $1.80(mf OTS).

A method of evaluation of the hot channel factors associated specifically with fuel element tolerances is presented. Numerical calculations which demonstrate the method are shown. (T.R.H.)

16723 WAPD-TM-138
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SPACE- AND TIME-DEPENDENT FLUX OSCILLATIONS (AND INSTABILITY) IN THERMAL REACTORS DUE TO NONUNIFORM FORMATION AND DEPLETION OF XENON. R. S. Wick. Aug. 1958. 46p. Contract AT-11-1-GEN-14. $1.25(OTS).

A theoretical treatment of the space- and time-dependent flux oscillations in an annular seed-blanket reactor due to nonuniform formation and depletion of xenon is developed by a linearized treatment. The distinction between coupling within the seed and through the central blanket is brought out in the analysis. These results are compared to a four-point model of the seed blanket reactor. The unity of various methods of analysis is shown by the use of the concept of a xenon "transfer function." (auth)

16724 WKNL-87
Kidde (Walter) Nuclear Labs., Inc., Garden City, N. Y.
REACTOR COMPUTATION METHODS. Sylvan Wallach. Feb. 15, 1957. 95p. For Glenn L. Martin Co.

Chapter one of this volume gives procedures for calculating infinite multiplication constants, critical masses, and long-term transients for nuclear reactors. The second chapter outlines calculation methods applicable to reactor control philosophy. Chapter three contains a bibliography with abstracts. (W.L.H.)

16725 Y-A2-183
Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.
CRITICAL CONDITIONS FOR CYLINDRICAL, WATER-TAMPED, AND WATER-MODERATED REACTORS. Reginald Gwin. Dec. 2, 1955. Decl. Aug. 28, 1958. 12p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40 (mf OTS).

Critical heights and U^{235} densities for cylindrical, water-tamped, and water-moderated reactors were calculated using "Water Boiler Theory." (W.D.M.)

16726 YAEC-52
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
QUARTERLY PROGRESS REPORT FOR THE PERIOD OCTOBER 1, 1957 TO DECEMBER 31, 1957. I. H. Coen and R. W. Garbe. Jan. 30, 1958. 97p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1.

An evaluation and the resulting conclusions of work performed are presented for each project in which definitive progress was made. The principle progress consisted of: improvement in the uniformity of spacing pellets in stainless steel tubes by horizontal and vertical stretching of the tubes; determination of bulk-boiling factors from the loss-of-coolant flow studies; the obtaining of encouraging results from the use of a basic permanganate-citrate method for the decontamination of stainless steel; calculation of the volume of the local boiling in the first core; selection of a combination resin-evaporation waste disposal system; review and modification of nuclear parameters and control rod worths; loading of the CRX core to criticality and the obtaining of test data from the loading operations; preparation of drawings and equipment specifications for the in-pile test loop in a fourteen-section package; and removal of irradiated fuel elements test specimens from the MTR and their shipment to KAPL for post-irradiation examination. The latest revised definitive mechanical, thermal, and nuclear design data for the first Yankee core are included. (For preceding period see YAEC-44.) (auth)

16727 YAEC-92
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
MONTHLY PROGRESS REPORT FOR THE PERIOD JULY 1 TO 31, 1958. H. E. Walchli and R. W. Garbe. Aug. 20, 1958. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $3.30(ph OTS); $2.40(mf OTS).

Progress in the design and development of the Yankee Power Reactor is briefly reviewed. (For preceding period see YAEC-89.) (W.L.H.)

16728 AEC-tr-3314
CALCULATION OF THE DISADVANTAGE FACTOR FOR THE MODERATOR IN A CYLINDRICAL LATTICE CELL. (Beräkning av "Disadvantage"-Faktorn för Moderatorn i en Cylindrisk Gittercell). B. Pershagen and I. Carlvik. Translated by W. K. Ergen (Oak Ridge National Lab.) from report AEF-69, Aktiebolaget Atomenergi, Stockholm, Nov. 1, 1956. 15p.

A method for determining the disadvantage factor for the moderator in a cylindrical lattice cell is described. The method is comparable in simplicity with the ordinary diffusion theory but gives much better accuracy as is shown by comparison with results given by the spherical harmonics and S_n methods. The formula for the disadvantage factor is shown to be practically identical with a formula derived in another way by Amouyal, Benoist and Horowitz. (auth)

16729 AEC-tr-3361
CALCULATION OF EFFECTIVE SURFACES FOR RESONANCE ABSORPTION IN TUBES AND PARALLEL

PLATES. (Beräkning av Effektiva Ytor för Resonans-Absorption i rör och Parallella Plattor.) I. Carlvik and B. Pershagen. Translated by Aase Vaslow (Oak Ridge National Lab.) from report AEF-49, Aktiebolaget Atomenergi, Stockholm, Dec. 1955. 15p.

The usual formula for estimating the resonance escape probability in a lattice assumes that the uranium lumps are far enough apart so that mutual shielding can be neglected. For certain types of fuel elements, for example, uranium tubes and parallel plates, and for close packed lattices, the surface absorption will be reduced due to mutual shielding. The usual formula for p can still be used if instead of the true surface S an effective surface $S_{eff} = \gamma S$ is inserted in the formula. Expressions for the shielding constant γ were derived for the case of a cylindrical tube and for infinite parallel plates of finite width. (auth)

16730 AEC-tr-3362

EXPONENTIAL PILE MEASUREMENTS ON R3a FUEL ELEMENTS. Rolf Persson. Translated by W. K. Ergen (Oak Ridge National Lab.) from report AEF-65, Aktiebolaget Atomenergi, Stockholm, Sept. 19, 1956. 14p.

Clusters of seven uranium rods were investigated in an exponential assembly. The material buckling was measured by an extrapolation procedure and the thermal diffusion length was established from the neutron intensity. (auth)

16731 AEC-tr-3377

ON THE THERMAL UTILIZATION FACTOR AND THE THERMAL DIFFUSION LENGTH IN A HETEROGENEOUS REACTOR. S. Gallone. Translated by Liz Appleby for Hanford Atomic Products Operation from Nuovo cimento, (10), 10, 1495-7(1953). 7p.

The condition of criticality of a reactor is deduced for a simple geometry by using the diffusion equation for a single cell. (T.R.H.)

16732

SELECTING THE REACTOR COOLANT. PART I. GENERAL CONSIDERATIONS. J. F. Ablitt. Atomics and Nuclear Energy 9, 316-17, 323(1958) Sept.

The main points which must be considered in the search for a suitable coolant for a chosen fuel and moderator are examined. The cost factors involved are discussed. (W.D.M.)

16733

MUTUAL SCREENING OF THE ELEMENTS IN A CLOSE-PACKED LATTICE DUE TO RESONANCE ABSORPTION. V. V. Orlov. Atomnaya Energ. 4, 531-8(1958) June. (In Russian)

The mutual screening effect of resonance absorber elements and slabs occurring when the thickness of the dividing moderator is either equal to or smaller than the neutron free path in the moderator was evaluated. It was assumed that the elements are small and that the absorption cross section is described by the Breit-Wigner equation. Calculations on parallel slab systems permitted the development of an equation for nearly homogeneous systems. It was shown that the approximation substitution of true cells by equivalent spherical cells, ordinarily permissible, leads to erroneous conclusions. A resonance absorption equation was derived for the spherical geometry of the absorber. (tr-auth)

16734

INFLUENCE OF NEUTRON RADIOACTIVITY ON REACTOR DYNAMICS. F. Cap (Univ. of Innsbruck, Austria). Atompraxis 4, 248-9(1958). (In German)

Within the framework of Fermi's age theory, the correction terms caused by the radioactive decay of the neutron are derived for Nordheim's equation. (auth)

16735

RESEARCH REACTORS. Albrecht Weber. Atomwirtschaft 3, 302-7(1958) Aug.-Sept. (In German)

The present state of development of research reactors and the progress made from 1955 to 1958 in the German Federal Republic are described. There are six imported reactors (three swimming pool reactors in Munich, Hamburg, and Jülich and two homogeneous reactors in Frankfort and Berlin) now in operation or being constructed. In addition the heavy water reactor FR-2 at Karlsruhe was developed in Germany. (J.S.R.)

16736

POWER REACTORS. Georg Leichtle. Atomwirtschaft 3, 307-10(1958) Aug.-Sept. (In German)

The present state of development of power reactors and the progress made from 1955 to 1958 in the German Federal Republic are described. The German 500 Mwe program is supposed to meet energy supply requirements as well as those of the atomic industry. Financing still represents the main problem. There are five energy supply groups and five reactor building firms engaged in preliminary talks. In addition two 15-Mwe experimental reactor power stations will be built. (J.S.R.)

16737

REACTOR CONTROL TECHNIQUES. L. Merz. Atomwirtschaft 3, 337-41(1958) Aug.-Sept. (In German)

In the German Federal Republic the emphasis, aside from theoretical considerations of reactor control, has been on the development of electrical and electromechanical reactor simulators. Special progress was made with impulse controllers using the conception of progressive control. (J.S.R.)

16738

REACTOR BUILDINGS, OPERATION, AND FUELS. H. Hardung-Hardung and G. Matz. Atomwirtschaft 3, 345-6(1958) Aug. Sept. (In German)

The development in the German Federal Republic of facilities and techniques for the manufacture of reactor materials is discussed. German industry can now meet the advanced quality requirements for the usual materials such as aluminum, concrete, lead, graphite, magnesium, or steel. (J.S.R.)

16739

CORROSION AND WATER PURITY CONTROL FOR THE ARMY PACKAGE POWER REACTOR. Richard J. Clark and A. Louis Medin (Alco Products, Inc., Schenectady, N. Y.). Corrosion 14, 419t-23t(1958) Sept.

The Army Package Power Reactor is a 10 Mw heat rated system designed to produce 2 Mw of electricity. The reactor, in operation since April 1957, is a pressurized water system. Problems facing the designer of such a system in the fields of corrosion and water purification are presented. A complete description of the primary purification system is included, along with performance data on individual components. The 2 cubic foot demineralizer has performed very satisfactorily, consistently maintaining coolant resistivity above 600,000 ohm cm. Primary coolant pH generally has averaged about 7.5 to 8.5, depending on the amount of in-leakage into the primary system. Operation of the purification system has required only minimal attention with even hydrogen control being self-regulating. The experimental in-plant equipment for determining crude levels, corrosion rates, and other related parameters, are described. Although still preliminary, it appears that the corrosion rate of system components is lower than the originally estimated 0.05 $mg/cm^2/mo$. (auth)

16740
REMOVAL OF CORROSION PRODUCTS FROM HIGH TEMPERATURE, HIGH PURITY WATER SYSTEMS WITH AN AXIAL BED FILTER. R. E. Larson and S. L. Williams (General Electric Co., Schenectady, N. Y.). Corrosion 14, 424t-8t(1958) Sept.

The concentration of corrosion products and other impurities which produce undesirable radionuclides must be maintained at extremely low values in the primary coolant systems of nuclear power plants to keep the resulting dose rate below certain maximum values. This has been normally accomplished in the past by low temperature ion exchange of the pressurized water coolant. Development of an axial bed filter which can remove radioactive corrosion products from high purity pressurized water coolant at operating temperatures is described. (auth)

16741
THE STRUCTURE OF THE GRAPHITE MODERATOR AT HUNTERSTON. I. A. B. Gaunt (General Electric Co. Ltd., London). G. E. C. Atomic Energy Review 1, 182-7(1958) Sept.

An account is given of the design of the graphite structure to be used for the reactors of the nuclear power station at Hunterston, in Scotland. A description is given of the method adopted to overcome the effects of Wigner growth, and the means by which the graphite is located and restrained so that free access can be obtained to both ends of the fuel element channels. Information is included on design requirements and the properties of graphite directly affecting design. (auth)

16742
THE REACTOR SERVICING MACHINE. K. J. Mitchell, D. J. Ingram, and B. H. Stonehouse. G. E. C. Atomic Energy Review 1, 199-208(1958) Sept.

A general description is given of a machine designed for remotely controlled maintenance operations on nuclear reactors. One such operation, the changing of a control rod and its drive mechanism, is described in some detail, with reference to schematic diagrams. Other diagrams and descriptions deal more briefly with further functions of the machine. (auth)

16743
THE DETERMINATION OF THERMAL STRESSES IN CONCRETE SHIELDS. I. W. Hannah. G. E. C. Atomic Energy Review 1, 209-16(1958) Sept.

The value of a better knowledge of thermal stress in concrete radiation shields is briefly discussed in relation to the Hunterston type of reactor structure and its possible structural developments. Some of the factors involved in accurate determinations of thermal stresses are outlined, and the experimental work being undertaken is summarized. (auth)

16744
OPERATING CONDITIONS AND THE POSSIBILITY OF THERMALIZATION IN THE RESEARCH CHANNELS OF THE SWIMMING POOL REACTOR. H. Knoepfel, Ch. Menoud, and P. Stoll (Physikalisches Institut, Zürich). Helv. Phys. Acta 31, 330-4(1958). (In German)

The neutron flux distribution in the research channel of the Saphir swimming pool reactor in Wurenlingen was determined with and without moderator, and the results are graphed. The temperatures of a lead and a bismuth block in the research channel were measured. Gas evolution in irradiated D_2O was also determined. The collimator used for (n,γ) experiments is described. (J.S.R.)

16745
THE FURTHER DEVELOPMENT OF THE UNITED KINGDOM NUCLEAR POWER PROGRAMME. John Cockcroft (United Kingdom Atomic Energy Authority). J. Brit. Nuclear Energy Conf. 3, 157-65(1958) July.

The changes in power station performance and in the nuclear program during the last 3 years are described. The increase in power output was achieved by engineering development, with a simultaneous increase in technological knowledge. A facet of reactor technology which is receiving attention is to ensure that present and future reactors can be operated safely at all times. A detailed design study of the sodium-graphite reactor and a research study of the pressurized water reactor were carried out, and it is concluded that neither of these seem competitive with gas-cooled reactors because of maintenance problems and the cost of U^{235}. The lines of future development include development of the gas-cooled graphite-moderated reactor to maximum potential and an investigation of the advantages of heavy water as a moderator. (J.R.D.)

16746
THE APPLICATION OF DIGITAL COMPUTERS TO NUCLEAR-REACTOR DESIGN. J. Howlett (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Brit. Nuclear Energy Conf. 3, 181-7(1958) July.

Computational problems arising in the design of a nuclear power reactor are reviewed. The numerical-mathematical methods available are described briefly in two broad classes, namely the discrete-particle (Monte Carlo) treatment of the neutron-transport problems and the analytical methods based on the transport equation. The use of digital computers in the different methods is discussed in general terms and three examples are considered in more detail: the calculation of the thermal utilization factor for a lattice by the spherical harmonics method, the direct numerical solution of the two-group diffusion equations for a cylindrical reactor and the calculation by Monte Carlo methods of the resonance escape probability for a graphite-uranium lattice. Finally there is a discussion of the standard of performance of computers likely to be required by nuclear engineers. (auth)

16747
TEMPERATURE TRANSIENTS IN GAS-COOLED THERMAL NUCLEAR REACTORS. J. H. Bowen and E. F. O. Masters (U.K.A.E.A., Industrial Group H. Q., Risley, Lancs, Eng.). J. Brit. Nuclear Energy Conf. 3, 188-200(1958) July.

The transient behavior of the Calder Hall type reactor in terms of the design and operating parameters is examined, including the transients arising from step changes in reactivity, steady changes in reactivity, step changes in cooling, and steady changes in cooling due to both circular-speed and gas-pressure changes. The program was carried out by means of an analog computer and by a graphical method which employs an approximate solution of the neutron-kinetic equations. It is concluded that the graphical method is useful for studying the transient characteristics of a reactor; however, experimental confirmation of the predicted results is desirable. (J.R.D.)

16748
EPITHERMAL EFFECTS ON CONTROL ELEMENT WORTH. Bertram Wolfe (General Electric Co., San Jose, Calif.). J. Nuclear Energy 7, 71-80(1958) Aug.

The Hurwitz-Roe constant-source control-element theory is extended to a two-group treatment in which the epithermal group is fed from a constant source and in turn feeds the thermal group. It is shown that when

there are no epithermal fissions, the absorption area for an element black in both the thermal and epithermal group can be written:

$$C = \frac{\tau_2}{\tau_2 - L^2} C_{HR}(\tau) + \frac{L^2}{L^2 - \tau_2} C_{HR}(L)$$

where τ_2 is the age from thermal energies to the epithermal cut-off energy, and C_{HR} is the Hurwitz-Roe one-group absorption area as a function of either L^2 or τ_2. When there are epithermal fissions, the effects of thermal absorptions are reduced by the factor

$$1 - \frac{\nu\Sigma_{f_2}}{\Sigma_{r_2}} \frac{\Sigma_{SD_1}}{\Sigma_{r_1}}$$

where Σ_{f_2} is the epithermal fission cross section, Σ_{r_2} is the epithermal removal cross section, and Σ_{SD_1} and Σ_{r_1} are respectively the slowing down and removal cross section in the group which includes all neutrons of energies above the epithermal groups. This effect of the epithermal fission holds whether the control element is thermally black, or both thermally and epithermally black. It is further shown that the methods outlined can be extended to an arbitrary number of groups. The results allow a multi-group analysis to be made in terms of the simpler one-group work. (auth)

16749
REACTOR EXPOSURE AND CRITICAL MASS. G. W. Stuart (General Electric Co., Richland, Wash.). J. Nuclear Energy 7, 97(1958) Aug.

The required critical mass in a thermal reactor is examined. The speculation is based on a hypothetical case in which a thermal reactor is just critical and has an arbitrary fuel distribution. From this, a theorem is developed that a reactor burns fuel in such a manner as to increase the required critical mass and shut itself off. (J.R.D.)

16750
NEUTRON PRODUCTION AND TEMPERATURE IN ZETA. K. A. George (Tata Inst. of Fundamental Research, Bombay). Nature 182, 745-6(1958) Sept. 13.

Discrepancies between apparently observed and the theoretically expected thermalization time in ZETA are discussed. Possible explanations are presented. (C.H.)

16751
HEAT CONDUCTION IN INTERNALLY COOLED NUCLEAR REACTORS. Roy A. Axford (Raytheon Mfg. Co., Waltham, Mass.). Nuclear Sci. and Eng. 4, 139-54(1958) Aug.

Several problems in heat conduction relating to internally cooled nuclear reactors are solved by means of successive Schwarz-Christoffel transformations. Formulas are derived for the computation of the thermal resistance between hot and cold fluids flowing through a solid in parallel channels of variously shaped cross sections, including the square, rectangle, and an oval approximation to the circle and the ellipse. (auth)

16752
THE STABILITY OF MULTIPASS REACTORS. John MacPhee. Nuclear Sci. and Eng. 4, 200-8(1958) Aug.

The stability of a multipass reactor having series coolant flow through the passes was considered. The investigation was predicated on the assumption that the effects of the temperature coefficient of reactivity of each pass can be superimposed. An analytical model was derived based on constant coolant flow and constant core inlet temperature. By making certain simplifying assumptions, a criteria was established which predicts the stability of the system as a function of the temperature coefficients of reactivity. It has been shown that a negative temperature coefficient in each pass is neither a necessary nor a sufficient condition for stable operation. (auth)

16753
APPLICATION OF THE DIFFUSION EQUATION TO THE PROBLEMS OF THE VENTILATION STACKS OF REACTORS. Tibor Hoffmann and Géza Németh (Dept. of Physics for Experimental Reactors, Hungarian Academy of Sciences). Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közlemenyei 5, 582-8 (1957) Nov.-Dec. (In Hungarian)

The radioactive impurity concentration coming out of a stack of length L is calculated on the basis of the simple diffusion theory, taking into account the half-life. The calculations are extended to the adsorbing (aerosol) and non-adsorbing (gas) case for horizontal winds and without wind. The results can be used in designing the stacks of reactors. (auth)

Nuclear Transformation

16754 AEC-tr-3258
SECONDARY NUCLEAR REACTIONS DURING BOMBARDMENT OF TIN BY FAST PROTONS. (Vtorichnyye Yadernyye Reaktsii pri Bombardirovky Olova Bystrymi Protonemi.) M. Ya. Kuznetzova(Kuznetsova), V. N. Makhedov, and V. A. Khalkin. Translated from a publication of the Joint Institute of Nuclear Research, U.S.S.R., p.1-14, 1957. 10p.

A study was made of the formation of tellurium and iodine under the action of protons with energies from 170 to 660 Mev. The data on the formation of iodine isotopes on exposure of tin were verified, and conclusions were drawn about the separate stages and secondary reactions. (J.R.D.)

16755
DISINTEGRATION SCHEME OF $_{76}Os^{193}$ BY RAPID β-γ AND γ-γ COINCIDENCES. Louis Feuvrais and Maurice Spighel. Compt. rend. 247, 287-90(1958) July 21. (In French)

The energy and half life of the levels of Ir^{193} formed by the β disintegration of Os^{193} were determined by rapid β-γ and γ-γ coincidences. The 558-, 460-, and 280-kev levels have a half life $T_{1/2} \leq 10^{-9}$ sec. The half life of the 73-kev level was confirmed as $T_{1/2} = 6.2 \times 10^{-9}$ sec. The 139-kev level has a half life $T_{1/2} = (1.05 \pm 0.25) \times 10^{-9}$ sec. A partial decay scheme of Os^{193} is given. (tr-auth)

16756
STUDY BY A NEW METHOD OF THE REACTIONS BETWEEN 1 Bev PROTONS AND LIGHT NUCLEI. Georges Philbert and Leopold Vigneron. Compt. rend. 247, 290-3 (1958) July 21. (In French)

The interactions between 1-Bev protons and light nuclei (C, N, and O) were observed in diluted nuclear emulsions. The events were classified into two categories: interactions with the emission of at least one "slow" particle (protons of less than 2.25 Mev or α particles of less than 9 Mev) or interactions without the emission of slow particles. A parallel study was made of the interactions of 1-Bev protons and heavy nuclei (Br and Ag) with the emission of between 3 and 8 particles. The two categories differ from each other by the angular distribution of the particles emitted with an energy less than 30 Mev. (tr-auth)

16757
(p,n) REACTION IN MANGANESE. B. Lobkowicz, H. Guhl, and P. Marmier (Physikalisches Institut,

Zürich). Helv. Phys. Acta 31, 320-2(1958). (In German)

By investigation of the γ spectra in (p,n) reactions in Mn^{55} the energy levels of Fe^{55} in the range from 0.1 to 2.5 Mev were determined. The energies and intensities of the γ lines are tabulated, and the energy level diagram of Fe^{55} is given and compared with previous results. (J.S.R.)

16758

PHOTOPRODUCTION OF ALPHA PARTICLES FROM SEVERAL METALLIC ELEMENTS. M. Elaine Toms and John McElhinney (U. S. Naval Research Lab. Washington). Phys. Rev. 111, 561-7(1958) July 15.

Photoproduction of alpha particles from copper was investigated by using 22-Mev bremsstrahlung to irradiate a "sandwich" consisting of a thin copper foil (2.75 mg/cm^2) placed between two Ilford E-1, 100-micron thick nuclear emulsions. The observed yield was $(3.9 \pm 0.6) \times 10^4$ alpha particles per mole-roentgen. The energy distribution of the alpha particles has a maximum near 8 Mev. In addition, photo-produced alpha particles from thin foils of eleven elements, including copper, have been detected by means of their tracks in nuclear emulsions. "Sandwiches" containing two target foils on either side of a lead stopping foil were exposed to 21.5-Mev bremsstrahlung hardened by 147.4 g/cm^2 of graphite. The photo-alpha yields observed with the hardened spectrum are given in terms of unhardened bremsstrahlung, having been multiplied by the calculated ratio of effective photons in the two spectra. These yields, in units of 10^4 alphas per mole-roentgen, are: Al—1.3, V—0.4, Fe—1.9, Co—2.3, Ni—3.9, Cu—2.6, Cu^{63}—3.6, Zn—8.2, Nb—0.5, Rh—0.3, Ag—0.17, and In—0.09. For the seven elements having $Z \leq 30$, there seems to be a correlation between the yield and the difference between the alpha and neutron binding energies. (auth)

16759

HIGH-ENERGY ALPHA PARTICLES FROM B^{12}. C. W. Cook, W. A. Fowler, C. C. Lauritsen, and T. Lauritsen (California Inst. of Tech., Pasadena). Phys. Rev. 111, 567-71 (1958) July 15.

An earlier investigation of the alpha-particle spectrum associated with the beta decay of B^{12} was extended to an alpha-particle energy of approximately 3 Mev. The high-energy spectrum appears to indicate a broad level in C^{12} having an excitation energy of 10.1 ± 0.2 Mev and a width at half-maximum of $\Gamma \approx 2.5$ Mev. The most probable spin and parity assignment for this level is $J = 0^+$, although $J = 2^+$ cannot be definitely excluded; for $J = 0^+$ the width is approximately the Wigner limit. It is found that $(0.13 \pm 0.04)\%$ of all decays of B^{12} lead to this state. (auth)

16760

ANALYSIS OF C^{12} + d REACTIONS. M. T. McEllistrem (Univ. of Wisconsin, Madison). Phys. Rev. 111, 596-607 (1958) July 15.

The $C^{12}(d,d)C^{12}$ scattering is analyzed at two levels in N^{14}, one at 12.42-Mev excitation and the other at 12.69 Mev. The lower level is assigned as 4^- and the upper as 3^+. A nuclear radius is assumed and reduced widths are obtained for the two levels. With the aid of the reactions $C^{12}(d,p)C^{13}$ and $C^{12}(d,p)C^{13*}$ (3.09-Mev level), partial level widths for the three modes of decay of N^{14*} are obtained. Both (d,p) reactions are shown to be consistent with the presence of stripping amplitudes and resonant compound nuclear amplitudes and also consistent with the $B^{10} + \alpha$ data of Shire et al. for the same excitation region in N^{14}. The (d,p) angular distributions are analyzed to obtain the reduced neutron widths of the ground and first excited states of C^{13}. An appendix gives an explicit partial-wave expansion of the differential cross section for reactions involving incident spins of 0 and 1 and outgoing spins of $\frac{1}{2}$ and $\frac{1}{2}$. (auth)

16761

THE BRANCHING RATIO OF THORIUM C. P. Rice Evans and N. J. Freeman (Univ. of London). Proc. Phys. Soc. (London) 72, 300-1(1958) Aug.

The branching ratio of thorium C (Bi^{212}) was determined from the intensities of the two alpha particle groups. Sources of ThB were electrodeposited from thoron on a polished brass surface, 1 mm in diameter, and were mounted 1 cm above an aperture of the same diameter in a mica disc covering the crystal. The branching ratio was found to be $\alpha/(\alpha + \beta) = 0.359 \pm 0.002$. (J.R.D.)

16762

THE RESONANT ABSORPTION OF γ-RAYS IN ^{14}N. G. M. Griffiths (Cavendish Lab., Cambridge, Eng.). Proc. Phys. Soc. (London) 72, 337-44(1958) Sept.

By use of a nitrogen-filled proportional counter, the resonant absorption of γ rays to the 8.06 Mev level in N^{14} has been observed by means of the $N^{14}(\gamma,p)C^{13}$ reaction. The inverse reaction $C^{13}(p,\gamma)N^{14}$ at the 554-kev resonance was used as the source of γ rays. The γ-ray flux was accurately measured with a scintillation counter, and from the results the width of the 8.06-Mev level for ground state γ-ray transitions was found to be 10.5 ± 0.6 ev. This is in good agreement with the value obtained from the results of Seagrave on the inverse reaction $C^{13}(p,\gamma)N^{14}$. Since the γ-ray energy is a function of angle due to a Doppler shift, the resonant character of the absorption has been shown by varying the angle of the proportional counter with respect to the proton beam direction and noting the change in proton yield. (auth)

16763

CONSERVATION OF PARITY IN A NUCLEAR INTERACTION AT 350 Mev. D. P. Jones, P. G. Murphy, and P. L. O'Neill (Univ. of Liverpool). Proc. Phys. Soc. (London) 72, 429-32(1958) Sept.

If parity is conserved, neutrons produced in the interaction of unpolarized protons with an unpolarized target should have zero longitudinal component of polarization. An experiment is described in which the longitudinal polarization of the 350-Mev neutron beam emerging from an internal beryllium target in a synchrocyclotron is measured. The result is that, if the reaction matrix describing the neutron production process contains a term $F(\sigma.P/P)$, where σ P are the neutron spin and momentum, then $|F|^2 \leq 3.6 \times 10^{-6}$ with 95% confidence. (auth)

16764

THE POLARIZATION OF NEUTRONS EMITTED FROM NUCLEI BY PROTONS. E. J. Squires (Atomic Energy Research Establishment, Harwell, Berks., Eng.). Proc. Phys. Soc. (London) 72, 433-6(1958) Sept.

A discussion is given of the effects of the nuclear potential, and of multiple scattering, on the polarization of neutrons produced when nuclei are bombarded by high energy protons. The results indicate that, in order to explain the observed polarization at large angles, in particular its sign, multiple scattering must play an important part in the process. (auth)

16765

THE STRIPPING MECHANISM IN THE REACTION $^9Be(\alpha, n)^{12}C$. N. W. Tanner (Cavendish Lab., Cambridge, Eng.). Proc. Phys. Soc. (London) 72, 457-9(1958) Sept.

An experiment is reported in which interference terms

from resonant processes in the reaction $Be^9(\alpha,n)C^{12}$ reduce to a simple form, allowing a more sensitive test for the stripping mechanism. The results indicate that stripping makes no important contribution to the reaction near 1 or 3 Mev. It seems likely that an amplitude for stripping of 10 or 20% relative to resonant processes would have shown up in the measurements as a marked departure from isotropy. (L.T.W.)

16766
RECENT PROGRESS IN THE THEORY OF NUCLEAR REACTIONS. L. A. Radicati (Univ. of Pisa, Italy). Rend. seminar. mat. fis. Milano 27, 153-9(1957). (In Italian)

A short discussion is given of Wigner's theory of nuclear reactions. The different approximations to the theory and their validity are briefly discussed. (auth)

16767
SOME PHOTO-REACTIONS ON LIGHT NUCLEI. V. N. Maikov (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 1406-19(1958) June. (In Russian)

Photographic emulsions were employed to investigate the reactions $C^{12}(\gamma,3\alpha)$, $O^{16}(\gamma,4\alpha)$, $(\gamma,p\alpha)$ on C^{12}, N^{14}, O^{16}, and $C^{12}(\gamma,pt)\,2\alpha$. The dependence of the effective cross section of the reactions on the γ-quantum energy and also the energy and angular characteristics of the disintegration products were determined. The contribution of the reactions $C^{12}(\gamma,p\alpha)\,Li^7$ and $C^{12}(\gamma,pt)\,2\alpha$ to the total cross section for star formation in the photon energy region from 30 to 80 Mev is estimated. Some possible mechanisms of the $(\gamma,p\alpha)$-processes are discussed. (tr-auth)

Particle Accelerators

16768 AECU-3824
Utah. Univ., Salt Lake City.
ION DISSOCIATION REACTIONS IN THE LINEAR, PULSED, TIME-OF-FLIGHT MASS SPECTROMETER. Technical Report No. VII. Morton E. Wacks and Austin L. Wahrhaftig. June 15, 1958. 114p. Project No. 5. Contract AT(11-1)-82. $18.30(ph OTS); $6.00(mf OTS).

The theoretical design of a linear, pulsed, time-of-flight mass spectrometer was considered including several possible modes of accelerating ions from the source into the field-free drift region where mass separation occurs. The best theoretical resolution was obtained when the ions were accelerated by an impulse short enough so that no ions left the ionization chamber during the time of its application and then were drawn into the main accelerating field by a low voltage pulse. Loss of ions from the ion chamber was considered, and the mass spectra of mixtures of Ne, Ar, and C_3H_8 were discussed with respect to ion loss by thermal diffusion and field penetration. (T.R.H.)

16769 CERN-58-17
European Organization for Nuclear Research, Geneva.
MASTER OSCILLATOR FOR PROGRAMMED ACCELERATION IN THE CERN PROTON SYNCHROTRON. W. Schnell. July 1958. 20p.

Design and performance data of a servo-controlled radiofrequency oscillator of high stability for the CERN proton synchrotron, which can be turned linearly over a wide range of frequencies by means of a d-c voltage, are presented. (W.D.M.)

16770 MURA-427
Midwestern Universities Research Assn., Madison, Wis.
BEAM EXTRACTION FROM AN FFAG SYNCHROTRON. Kent M. Terwilliger. Aug. 15, 1958. 10p. Contract AT(11-1)-384. $3.30(ph OTS); $2.40(mf OTS).

A combination pulsed and d-c magnetic field system is described which will extract the beam from an FFAG spiral sector synchrotron with essentially no loss in betatron phase density, permitting the use of this type of synchrotron as a high-intensity injector into a pair of colliding beam storage rings. (auth)

16771 NYO-8583
Rochester, N. Y. Univ.
STUDY OF THE FEASIBILITY OF A FERRITE MODULATION SYSTEM FOR AN FM CYCLOTRON. Kurt Enslein. June 10, 1958. 48p. Contract AT(30-1)-875. $7.80(ph OTS); $3.30(mf OTS).

An analysis of a ferrite modulation system for a synchrocyclotron is presented. It is shown that such a system is feasible at present. The analysis was performed by numerical computation and substantiated by a scaled experiment. Extensive data are obtained from the computation and are available in microfilm form. The computer program is listed. (auth)

16772 UCRL-8269
California. Univ., Berkeley. Radiation Lab.
450-Mev/c K^- AND $\bar{p}$ BEAMS AT THE NORTHWEST TARGET AREA OF THE BEVATRON SEPARATED BY THE COAXIAL VELOCITY SPECTROMETER. Nahmin Horwitz, Joseph J. Murray, Ron R. Ross, and Robert D. Tripp. June 1958. 19p. Contract W-7405-eng-48. $0.50(OTS).

Enriched beams of 450 Mev/c K^- mesons and antiprotons have been produced by separation with the coaxial static electromagnetic velocity spectrometer. Characteristics of the final separated beams as observed in the 15-inch hydrogen bubble chamber are given together with a detailed description of the beam optics and apparatus. (auth)

16773
THE TRANSITIONAL MODE IN A SYNCHROTRON USING INITIAL BETATRON ACCELERATION. I. S. Danilkin and V. E. Pisarev. Atomnaya Energ. 4, 503-9(1958) June. (In Russian)

The transition process (from betatron to synchrotron acceleration) of slow adiabatic adjustment to a 250-Mev synchrotron field was studied. The performance and theoretical data for synchrotrons using initial betatron accelerators were appraised, and certain characteristics in betatron acceleration (electron distribution by energies, etc.) were found. The dependence of accelerated particle beam intensity on the amplitude of acceleration intensity is used for determining the amplitude intensity of the endovibrator. (tr-auth)

16774
PARTICLE ACCELERATORS. I. SCIENTIFIC CONSIDERATIONS. M. L. Leprince-Ringuet. Énergie nucléaire 2, 161-7(1958) July-Sept. (In French)

The evolution of high energy accelerators is reviewed. The principles of construction and operation of the cyclotron, the synchro-cyclotron, and the synchrotron are discussed. (J.S.R.)

16775
PARTICLE ACCELERATORS. II. CONSTRUCTION PROBLEMS. R. Maillet. Énergie nucléaire 2, 168-79(1958) July-Sept. (In French)

After a review of the general formulas describing the motion of particles in accelerators, the characteristic dimensions of the Saclay synchrotron are discussed. Beam stability, magnet poles, chamber construction, and the accelerating cavity are described in more detail. (J.S.R.)

16776
28 Mev ELECTRON-ACCELERATOR PROJECT FOR THE C.E.N. (FRENCH CENTER FOR NUCLEAR RESEARCH) AT SACLAY. Leboutet, E. Picard, and Vastel. L'onde Électrique 37, 8p.(1957) Jan. (In French)

The various considerations that motivated the choice of an accelerator of this type are reviewed giving basic design data. This accelerator plant consists of 3 cavity klystron HF sources, accelerator-guide consisting of a succession of $\pi/2$ cavities, external shield of concrete material providing complete radiation-proofing and supporting the focussing coils, Pierce type electron gun, mutually synchronized modulators, over-all protection against radiation leakage provided by concrete work embodying lead stabs for local sheating reinforcement. Operational facilities are provided by openings in the concrete mass, tap off points and pneumatic transmission lines for remote simple control. (auth)

16777
DESIGN OF REGENERATIVE EXTRACTORS FOR SYNCHROCYCLOTRONS. I. SMALL-AMPLITUDE EXTRACTION. Warren Fenton Stubbins (Univ. of California, Berkeley). Rev. Sci. Instr. 29, 722-5 (1958) Aug.

The extraction of particles from the nonlinear magnetic field of a synchroclytron by a single magnetic perturbation is studied by use of a general approximation to the magnetic field and a calculation technique closely tied to the physical process. The analysis is useful for extraction amplitudes of several inches. Regenerator strengths are computed as an illustrative example. (auth)

16778
REFLUXING LIQUID HYDROGEN TARGET. Robert R. Wilson (Cornell Univ., Ithaca, N. Y.). Rev. Sci. Instr. 29, 732(1958) Aug.

A liquid hydrogen target is described which obviates the necessity for the usual liquid nitrogen jacket. No vacuum pump is necessary since the cold hydrogen immediately condenses all the air in the chamber. The target region proper is a cylinder 1.5 in. OD by 3 in. long which is coaxial with the x-ray beam passing through it from the synchrotron. (A.C.)

16779
EQUATION FOR BETATRON OSCILLATIONS CONSIDERING THE RADIATION FRICTION. A. N. Matveev. Vestnik Moskov. Univ. 12, No. 5, 63-6(1957). (In Russian)

Equations are derived for betatron oscillation taking account of radiation friction. The motion is studied in the system coördinate connected with one of the electrons. The system coördinate was selected for the purpose of observing the oscillations in non-inert, normal coördinates. (R.V.J.)

Radiation Absorption and Scattering

16780 CF-57-12-10
Oak Ridge National Lab., Tenn.
THE EFFECT OF ANISOTROPIC SCATTERING ON THE NEUTRON FLUX IN AIR. C. D. Zerby. Dec. 4, 1957. 9p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The Monte Carlo code for calculating the fluxes and dose rates of air-scattered neutrons was altered to use an anisotropic scattering cross section proportional to $1 + a \cos \theta$ in the cm system. The cases investigated were for a point monodirectional beam of 5-Mev neutrons in an infinite volume of air of density 0.00125 g/cm^3. (W.D.M.)

16781 ORNL-2586
Oak Ridge National Lab., Tenn.
ANALYSIS OF THE RECENT TSF SECONDARY GAMMA-RAY EXPERIMENT. F. L. Keller and O. S. Merrill. Sept. 23, 1958. 50p. Contract W-7405-eng-26. $1.50(OTS).

Since the existing experimental data on gamma rays produced by the inelastic scattering of neutrons with oxygen and nitrogen are rather sparce, it is necessary to rely upon theoretical cross sections to predict the spectra of inelastic scattering gamma rays produced by an ordinary neutron flux distribution. Because of the model used in the cross section calculation a considerable amount of uncertainty existed in regard to the accuracy of these results. In order to provide a check on the results of such calculations, an experiment was performed at the ORNL Tower Shielding Facility to directly measure the spectra of capture and inelastic scattering gamma rays produced in air by a reactor neutron spectrum. Unfortunately, it was necessary to make these gamma-ray measurements behind a thick shield through which a long water collimator was inserted. Hence, before a direct comparison could be made between the calculations and the experiment it was necessary to first calculate the spectra of capture and inelastic scattering gamma rays produced in air, then to determine the effect of attenuation and buildup in the water collimator, and finally, to include the detector response functions. When the calculated and measured pulse-height distributions were compared the shapes were found to be in excellent agreement. This indicates that considerably more confidence may be placed in calculations which use spectra of inelastic scattering gamma rays determined from the existing theoretical cross section. (auth)

16782
EXTINCTION EFFECTS IN NEUTRON SCATTERING FROM SINGLE MAGNETIC CRYSTALS. Walter C. Hamilton (Brookhaven National Lab., Upton, N. Y.). Acta Cryst. 11, 585-94(1958) Sept.

Results arising from the treatment of magnetic scattering of neutrons, taking due account of the possibility of polarization of the neutron beam, indicate that the usual expressions for primary and secondary extinction must be modified in certain cases. Extinction, particularly primary extinction, will be generally more severe for reflections which have both nuclear and magnetic contributions than for either pure nuclear or pure magnetic reflections. Formulas and curves are presented for primary and secondary extinction corrections which are applicable to both magnetized and unmagnetized ferromagnetic or antiferromagnetic crystals. Some of the results obtained may be conveniently used to determine relative amounts of primary and secondary extinction, and consequently both mosaic block size and angular distribution. Many of the calculations are of interest in predicting the effects of extinction on experiments designed either to produce or use polarized neutron beams. The precession of the neutron polarization axis about the magnetic axis can affect the reflected intensity if extinction is severe. This effect is discussed briefly and is shown to be serious only for magnetized crystals. The appendix discusses the necessary changes in the scattering formulas if all the spins in the unit cell do not lie along a unique magnetic axis. (auth)

16783
RESONANT NEUTRON CAPTURE IN AN INFINITE UNIFORM MEDIUM. G. I. Marchuk and F. F. Mikhailus. Atomnaya Energ. 4, 520-30(1958) June. (In Russian)

The problem of slowing down neutrons from a uni-

formly distributed source in an infinite homogeneous medium with strong resonance absorption was studied. The solution of the conjugated equation indicates the possibility of neutron (with energy E) escape from resonance absorption during the moderation process to a certain asymptotic energy. The solution of the basic and conjugated problem permits the application of perturbation functions for the evaluation of the effect of Doppler broadening of resonance level on the resonance integral. Developed methods were used for calculations of collision densities and resonance integrals for the first level of U^{238}(E_0 = 6.7 ev) in pure uranium and in uranium oxide UO_2. (tr-auth)

16784

ENERGY SPECTRA OF SECONDARY ELECTRONS EMITTED BY A METAL IRRADIATED BY A RAPID ION BEAM. Ferdinand Pradal and René Simon. Compt. rend. 247, 438-41(1958) July 28. (In French)

The energy spectra of electrons emitted by Al, W, Cu, Co, Ta, Zn, Au, Mo, Ni, and Pt bombarded with argon ions were analyzed with a magnetic spectrograph. The results showed that these spectra are represented by a distribution law of the form $\log i/i_0 = -eV/kT$. It is possible to associate with each metal a temperature of equivalent emission. (tr-auth)

16785

POLARIZATION OF NEUTRONS SCATTERED BY DEUTERONS. M. Brüllmann, H. J. Gerber, and D. Meier (Physikalisches Inst., Zurich). Helv. Phys. Acta 31, 318-19(1958). (In German)

The polarization for the elastic scattering of 3.27-Mev neutrons by deuterons were measured with respect to the deviation of the nucleon-nucleon interaction from the center of force. The measuring method and the apparatus used are described. The results for various scattering angles are tabulated. (J.S.R.)

16786

ELECTROMAGNETIC PROPERTIES OF THE NUCLEON AND RELATIVISTIC ELECTRON-PROTON SCATTERING ACCORDING TO MESON THEORY. Lalit Kumar Pandit (Univ. of Zürich). Helv. Phys. Acta 31, 379-412(1958).

The relativistic cut-off prescription of Arnous and Heitler is used to calculate the anomalous magnetic moments of the nucleons and the elastic scattering of high energy electrons by protons on the basis of charge-symmetrical pseudoscalar meson theory, using both pseudoscalar and pseudovector couplings. The calculations are carried to the first order in perturbation theory. Good agreement is found with the experimental results of Hofstädter et al., on the electron proton scattering. Further the non-relativistic limit of the anomalous moments was studied, and a discrepancy in the results of the usual non-relativistic meson theory models was pointed out and treated. (auth)

16787

SCATTERING OF THERMAL NEUTRONS IN BERYLLIUM OXIDE. R. C. Bhandari, L. S. Kothari, and K. S. Singwi. J. Nuclear Energy 7, 45-50(1958) Aug.

Detailed calculations of the scattering of thermal and cold neutrons, average logarithmic energy decrement, mean energy loss per collision, the slowing-down age and time, and the variation of the transport cross section with energy have been made for the first time for beryllium oxide, which is an important moderator material. The calculated value of the average transport cross section is in good agreement with the experimental value as deduced from the diffusion length measurement. The agreement between the calculated and the observed total scattering cross section in the energy range investigated is also very good. However, it is not possible to compare the calculated age with the experimental value, since the former is calculated neglecting absorption. (auth)

16788

ELASTIC AND INELASTIC SCATTERING OF PROTONS FROM NEON. Michiya Kondo and Takashi Yamazaki (Osaka Univ.). J. Phys. Soc. Japan 13, 771-6(1958) Aug.

The angular distributions of protons elastically scattered from Ne and inelastically scattered from Ne^{20} (Q = 1.63 Mev) were measured from 30 to 165°C in the laboratory system at bombarding energies of 4.7, 4.9, 5.1, 5.3, and 5.5 Mev. Photographic plates were employed for the detection of scattered particles. The distributions for the elastic scattering or protons varied markedly with the primary energies, while the five distributions for the inelastic scattering had roughly similar shapes. (auth)

16789

ANGULAR DISTRIBUTION OF PROTONS INELASTICALLY SCATTERED FROM Si^{28} AND Mg^{24}. Shotaro Yamabe, Michiya Kondo, Takashi Yamazaki, and Atsutomo Toi (Osaka Univ.). J. Phys. Soc. Japan 13, 771-81(1958) Aug.

The angular distributions and the excitation curves of protons inelastically scattered from Si^{28} (Q = −1.78 Mev) and Mg^{24} (Q = −1.37 Mev) have been measured in the energy range E_p = 4.8 to 5.7 Mev. A broad resonance was observed in each excitation functions. The angular distributions in Mg^{24} show an asymmetry about the center-of-mass scattering angle $\theta = 90°$ and a strong dependence with the energy of incident protons, while in Si^{28} the angular distributions are more symmetric than in Mg^{24}. (auth)

16790

POLARIZATION OF INTERNAL BREMMSTRAHLUNG. István Lovas (Dept. of Physics for Experimental Reactors, Hungarian Academy of Sciences). Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közlemenyei 5, 613-17(1957) Nov.-Dec. (In Hungarian)

The circular polarization properties of internal bremsstrahlung are considered. The emission probability of a photon of energy k and polarization P was determined. The right and left handed circular polarization is characterized by P = +1 and P = −1, respectively. The photon emission probability was calculated by means of the two component theory of the neutrino. The following result was obtained:

$$w(k_1P) = \left(\frac{f^2e^2}{16\pi^5}\right)\left(\frac{|M|^2}{k}\right)(J_1 \pm P_1J_2)$$

(M is the nuclear matrix element and J_1 and J_2 are functions of k). The degree of right handed circular polarization is: $P = \pm J_2/J_1$. The signs − and + refer to ST and VA interactions, respectively. The degree of polarization is small in the low energy range and approaches unity for the maximum photon energy. (auth)

16791

THE THEORY OF SMALL ANGLE SCATTERING FROM EXTENDED DISLOCATIONS. H. H. Atkinson and P. B. Hirsch (Cavendish Lab., Cambridge, Eng.). Phil. Mag. (8) 3, 862-6(1958) Aug.

The theory of small angle scattering from dislocations (Atkinson and Hirsch 1958) has been extended to take into account the splitting of dislocations into partial dislocations. At very small angles the splitting does not

change the scattered intensity, but its effect becomes important as the angle increases till at large angles the intensity is reduced to $\frac{2}{3}$ of its value at zero angle. It is suggested that it may be possible to determine the widths of extended dislocations from the shape of experimental scattering curves for deformed metals. (auth)

16792

POLARIZATION EFFECTS IN INTEGRATED BREMSSTRAHLUNG CROSS SECTION. Haridas Banerjee (Indian Inst. of Tech., Kharagpur). Phys. Rev. 111, 532-4(1958) July 15.

The Born approximation bremsstrahlung cross section, summed over the outgoing electron's spin states and integrated over its momentum directions, is obtained for arbitrary polarizations of the initial electron and the outgoing photon. A brief discussion is given of the way in which the photon polarization depends on that of the incident electron. (auth)

16793

INELASTIC SCATTERING OF 14-MEV NEUTRONS FROM CARBON AND BERYLLIUM. J. D. Anderson, C. C. Gardner, J. W. McClure, M. P. Nakada, and C. Wong (Univ. of California, Livermore). Phys. Rev. 111, 572-4 (1958) July 15.

The angular distributions of the neutrons from the reactions $Be^9(n,n')Be^{9*}$, Q = –2.43 Mev, and C^{12} $(n,n')C^{12*}$, Q = –4.43 Mev, were measured from 25 to 140°, employing 14-Mev incident neutrons. Neither distribution is symmetric about 90°; the inelastically scattered neutrons are peaked in the forward direction. The $C^{12}(n,n')$ first-level angular distribution, which agrees with a recent measurement of the $C^{12}(p,p')$ distribution, is in good agreement with the prediction of the Levinson-Banerjee direct interaction theory. The integrated inelastic scattering cross sections for the Be^9 and C^{12} first levels are 0.17 ± 0.03 and 0.22 ± 0.03 b, respectively. The 4.43-Mev de-excitation gamma rays from C^{12*} are symmetric about 90°. The gamma-ray production cross section at 90° is 13.1 ± 2.0 mb/sterad. No gamma rays associated with Be^{9*} are seen. It is concluded that about one-third of the (n,2n) cross section at 14 Mev is a two-stage process proceeding via the 2.43-Mev level in Be^9. (auth)

16794

POLARIZATION OF BREMSSTRAHLUNG FROM POLARIZED ELECTRONS. C. Fronsdal and H. Überall (CERN, Geneva). Phys. Rev. 111, 580-6(1958) July 15.

The polarization of bremsstrahlung emitted from polarized electrons was analyzed in the Born approximation. Spins of the final electron are summed over. Differential cross sections are given, and are integrated over final electron directions. The results are valid for all electron energies, subject only to the limitations on the validity of the Born approximation. Screening is taken into account by using an exponential atomic form factor. Methods for relativistic spin description are discussed. (auth)

16795

MULTIPLE SCATTERING OF 600-Mev ELECTRONS IN THIN FOILS. R. F. Mozley, R. C. Smith, and R. E. Taylor (Stanford Univ., Calif.). Phys. Rev. 111, 647-9 (1958) July 15.

The beam of the Stanford Mark III linear accelerator was used to measure the width of the angular distribution of electrons multiply scattered in thin Be, Al, and Au foils. The results are in agreement with the predictions of the Molière theory. (auth)

16796

DISPERSION RELATIONS FOR K MESON-NUCLEON SCATTERING. Keiji Ig (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 19, 238-48(1958) Mar.

Dispersion relations for K meson-nucleon scattering are derived on the analogy of pion-nucleon scattering. Assuming the spin of K mesons to be zero, it is pointed out that there is an essential difference between the dispersion relations for K mesons with both types of interactions: scalar and pseudoscalar. The contributions to the scattering amplitude arising from the unphysical region, due to the exothermic reactions $K + P \rightarrow \pi + \Lambda$ and $K + P \rightarrow \pi + \Sigma$, are discussed. (auth)

16797

ELASTIC SCATTERING OF DEUTERONS BY HEAVY NUCLEI. Yoshihiko Nishida (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 19, 389-403(1958) Apr.

The elastic scattering of deuterons by heavy nuclei is investigated through the analysis of available data at 11 and 15.2 Mev. Because $Ze^2/\hbar v \gg 1$ and the reduced wave-length of the deuteron is much shorter than the nuclear dimensions, the center-of-mass motion of the deuteron can be described by the classical approach. The wave mechanical description is applied only to the internal motion of the deuteron. It is shown that for deuteron scattering at 11 Mev the departure from the Rutherford scattering can be completely attributed to the electric breakup of the deuteron. The result of the analysis of the deuteron scattering at 15.2 Mev shows that although at larger scattering angles the effect of the nuclear absorption due to the diffractional scattering of deuterons cannot be neglected, the main contribution to the departure from the Rutherford scattering comes from the effect of the electric breakup of the deuteron. The calculation of the cross section of the electric breakup by the semi-classical method of the virtual quanta modified for the non-relativistic case is performed to compare with the result obtained from the analysis. The limitation of this method is also discussed. (auth)

16798

ON SOLUTION OF THE KINETIC EQUATION FOR TRANSFER OF NEUTRONS OR GAMMA QUANTA BY THE PARTIAL PROBABILITY METHOD. I. G. Dyadkin (All Union Research Inst. of Geophysics, Volga-Urals Branch). Zhur. Eksptl'. i Teoret. Fiz. 34, 1504-17 (1958) June. (In Russian)

Solution of the kinetic equation for slowing down or diffusion of neutrons and propagation of γ quanta is reduced to the simpler problem of multiple integration. An exact solution of the kinetic equation (stationary as well as nonstationary) is found in the form of a sum the x-th term of which is approximately a 3x-fold integral. The latter has the meaning of the transition probability of a particle from one point in its phase space to another after x collisions. In the particular case of slowing down and diffusion of neutrons with a constant mean free path, it is shown that this exact solution, which depends on all six variables (three space coordinates and three momentum projections) can be reduced to simple quadratures and sums. (tr-auth)

16799

MULTIMAGNON PROCESSES IN THE SCATTERING OF SLOW NEUTRONS IN FERROMAGNETICS. S. V. Malyeev. Zhur. Eksptl'. i Teoret. Fiz. 34, 1518-25 (1958) June. (In Russian)

The total cross section for inelastic scattering of neutrons in ferromagnetics involving the scattering of a magnon and emission of another is computed. It is shown that the cross section is small compared with the cross section for scattering accompanied by absorption

or emission of a magnon. It is also shown that the role of scattering processes in which more than two magnons participate is negligible. (tr-auth)

16800
ON THE DISPERSION RELATIONS AND THE DEDUCTION OF THE EQUATIONS FOR K-MESON SCATTERING. A. M. Brodskii (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 34, 1531-8(1958) June. (In Russian)

Scattering of K mesons on nucleons is investigated with account of Ξ-particle formation. Besides the usual principles of the standard theory, use is made of the causality condition and unitarity condition on the S matrix. These conditions along with the additional assumption of invariance of the interaction with respect to rotations in four-dimensional isotopic space yield Low type equations which are valid at not very high energies and are similar to the Low equations for π-meson scattering. The form of the interaction enters the equation by means of an inhomogeneous term. The equations obtained are also a generalization of the dispersion relations for scattering by arbitrary angles. (tr-auth)

Radiation Effects

Refer also to abstract 16270.

16801 ANL-5538
Argonne National Lab., Lemont, Ill.
"PIN-CUSHION" IRRADIATION TESTS OF URANIUM AND ITS ZIRCONIUM ALLOYS. Metallurgy Program 6.1.1. S. H. Paine and F. L. Brown. Mar. 1956. 41p. Contract W-31-109-eng-38. $1.25(OTS).

An irradiation test of $\frac{1}{16}$ in. diameter × $\frac{3}{16}$ in. long U^{235} and U^{235}-Zr alloy specimens, in the range 2 to 20 wt. % Zr, is described. The small pins were mounted in heat transfer blocks, or "cushions," in such a way that surface roughening and length changes could be observed, recorded, and compared for five stabilizing heat treatments up to exposure levels of approximately 1% total atom burnup. Addition of 2% Zr was found to be very beneficial, but the behavior of the alloys underwent distinct changes in going from 2 to 4 wt. % Zr. Material, both as-cast and subsequently isothermally treated, changed from minus to plus elongation, whereas wrought materials, either gamma-slow cooled or isothermally treated, changed from plus to minus behavior. Beta-quenched wrought material varied unpredictably. Addition of Zr up to 20% showed further improvement in stability for all treatments. Factors which may have contributed to this behavior are discussed. (auth)

16802 HW-56195
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
RADIATION DAMAGE TO CONCRETE. R. G. Clark. Mar. 31, 1958. 23p. Contract W-31-109-Eng-52. $0.75(OTS).

A literature survey on the subject of radiation damage to concrete was proposed, because the question of damage continues to be raised. A compilation of significant results to date and a current bibliography on the subject are presented. Data are available for conditions of flux up to 2×10^{19} nvt (thermal) and temperature to 120°C. Under these conditions, radiation damage to concrete is apparently insignificant. All effects on concretes due to radiation per se were too slight to reliably measure because of the gross effects from the increased temperatures during exposure. (auth)

16803 NAVORD-6127
Naval Ordnance Lab., White Oak, Md.
NUCLEAR IRRADIATION EFFECTS ON FERROMAGNETIC CORE MATERIALS. R. S. Sery and D. I. Gordon. June 3, 1958. 72p. $12.30(ph OTS); $4.50 (mf OTS).

Effects of nuclear irradiation on the magnetic properties of 14 representative core materials were investigated. Measurements before, during, and after irradiation were made at a flux level of about 10^{12} neutrons/cm² sec and for a total integrated neutron flux of ~10^{18} nvt. The fast flux (E>1 ev) was about 10^{11} n/cm² sec and the gamma flux ~10^{11} photons/cm² sec (E was 1 to 2 Mev). The temperature of the cores was 70 to 80°C with 10 to 20% of the total temperature attributed to gamma heating. The results of this work show: that the high nickel–iron alloys which have the highest permeabilities and lowest coercive forces showed the greatest changes in magnetic properties. Supermalloy, 4-79 Mo Permalloy, and Mumetal showed, respectively, increases of 815, 423, and 158% in coercive force and decreases of 93, 89, and 66% in their initial permeabilities. Changes in the corresponding properties in unoriented 48 nickel–iron and oriented 50 nickel–iron ranged from 30 to 100%. Grain oriented and unoriented 3 to 3.5 silicon–irons and a 3-1 silicon–aluminum–iron (having square loop characteristics) showed small changes in their magnetic properties. The magnetic properties of a thermally ordered 16-aluminum–iron improved somewhat, while those of a thermally disordered material showed negligible changes. Although subject to limitations imposed by induced radioactivity, 2 V Permendur may be useful in some applications because it showed negligible changes due to irradiation and also operated successfully (in a saturable reactor circuit) up to 500°C. Four pressed powder cores and a nickel-ferrite core showed essentially no changes in their d-c magnetic properties and a-c permeabilities. Of these, two carbonyl-iron cores (one with a glass binder and the other with a plastic binder) showed negligible changes in their high-frequency loss characteristics. However, the loss factors of nickel-ferrite, 2-81 Mo Permalloy, and Sendust flake measured at 25 to 50 kc/s increased by 47, 94, and 93%, respectively. Structure-sensitive properties (such as permeability, coercive force, and remanence) changed significantly, suggesting changes in degree of order. Saturation induction, a structure insensitive property, was essentially unaffected by irradiation. Measurements made during the course of the irradiation showed progressive changes in properties with nvt. Some of the curves of initial permeability and coercive force as functions of nvt were found to be hyperbolic or exponential in form. Some of the hysteresis loops became highly distorted with irradiation and some materials showed a saturation of radiation damage effect. Reannealing of a 4-79 Mo Permalloy restored its pre-irradiation switching time characteristic, after irradiation had destroyed this property, indicating that transmutation effects were negligible. (auth)

16804 NYO-8531
Brown Univ., Providence.
RADIATION DAMAGE STUDIES USING THE TECHNIQUES OF ELECTRON-SPIN PARAMAGNETIC RESONANCE. Period Covered: May 1, 1957 through April 30, 1958. P. J. Bray and A. O. Williams, Jr. Mar. 10, 1958. 13p. Contract AT(30-1)-2024. $3.30 (ph OTS); $2.40(mf OTS).

A Varian V-4500 electron-spin paramagnetic reso-

nance spectrometer and associated 6-inch electromagnet have been placed in operation. Measurements of the magnetic field are made with a Pound-Watkins spectrometer constructed in the laboratory. Studies have been made of single crystals of LiF which have received thermal neutron irradiation dosages up to 72 hours in a flux of 2.3×10^{12}/cm^2-sec. The observed resonance envelope and hyperfine splittings are not in agreement with F-center theory. A dependence of the hyperfine splitting on crystal orientation in the magnetic field has been noted. Crystals of KCl, KBr, KI, NaF, NaCl, RbI, CsBr, and CsI which have received reactor or gamma irradiation are under investigation. (auth)

16805 SCL-T-195

A NEW ATTEMPT TO EXPLAIN THE PHENOMENA OF COLOR CENTERS. (Nouvel Essai d'Interprétation des Phénomènes liés aux Centres Colorés.) D. Saint-James. Translated by Marcel I. Weinreich (Sandia Corp.) from J. phys. radium 17, 907-8(1956). 5p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 13549. (W.D.M.)

16806

HOW RADIATION DAMAGES METALS. PART II. EFFECTS ON MECHANICAL PROPERTIES. M. J. Makin. Atomics and Nuclear Energy 9, 318-22(1958) Sept.

Experimental data are given on radiation damage in metals, and theoretical interpretations of the cause of the damage are discussed. (W.D.M.)

16807

INCREASE OF THE PHOTOCONDUCTIVITY OF MONOCRYSTALS OF CADMIUM SULFIDE BY IRRADIATION IN AN ATOMIC PILE. Michel Martineau. Compt. rend. 247, 639-43(1958) Aug. 11. (In French)

Irradiation of monocrystals of cadmium sulfide in an atomic pile in a flux of 10^{18} neutrons/cm^2 produces a distinct augmentation of the photoconductivity sensitivity in the visible range and for x rays. The augmentation is caused by defects created in the crystalline lattice by neutron shock. (tr-auth)

16808

AN INVESTIGATION OF THE RADIOSENSITIVITY IN THE CELLS REPEATEDLY EXPOSED TO IONIZING RADIATION. E. Ya. Graevskii and E. G. Zinov'eva (Svertsov Inst. of Animal Morphology). Doklady Akad. Nauk S.S.S.R. 121, 837-40(1958) Aug. 11. (In Russian)

Experiments were performed on Paramecium caudatum in order to determine the ability of single cell organisms to counteract radiation injury and their ability in adapting to it. The changes in the division rate and the survival of the simplest forms after single and repeated irradiation are used as criteria in the study. (R.V.J.)

16809

EFFECTS OF INTENSE RADIATION FROM NUCLEAR REACTORS ON MATERIALS. James C. Wilson (Oak Ridge National Lab., Tenn.). Energie nucleaire 2, 207-12(1958) July-Sept. (In French)

Attention is drawn to the problems which are given the engineer charged with the selection of materials in the course of research on radiation effects and on the application of the knowledge gained. After a consideration of all possible knowledge on the cause and significance of the effects of irradiation and the exceptional conditions to which the materials are exposed in a reactor, all possible variations in the execution of the tests and in the interpretation of their results should then be considered. It is shown that radiation effects do not constitute a simple factor modifying known properties of known materials. They can concern numerous aspects of the problem of matter. (J.S.R.)

16810

RADIATION EFFECTS IN SOLIDS. R. Smoluchowski (Carnegie Inst. of Tech., Pittsburgh). Nuovo cimento (10) 7, Suppl. No. 2, 523-43(1958).

The theory of radiation effects in solids is summarized, and the various phenomena are illustrated with examples. The effects produced by radiation are electronic excitation, elastic collisions, displacements, inelastic collisions, and transmutations. The effects on alkali halides, alpha brass, semiconductors, graphite, and uranium are specifically discussed. (J.S.R.)

16811

SUPERFLUID HELIUM INSIDE NEUTRON-IRRADIATED SILICON. P. H. Keesom and G. Seidel (Purdue Univ., Lafayette, Ind.). Phys. Rev. 111, 422-4(1958) July 15.

The specific heat of a boron-doped silicon crystal, which was first irradiated with thermal neutrons and then annealed, showed a pronounced peak at the normal λ temperature of liquid helium. The anomaly is due to the existence of helium inside the ingot, this helium being created by the boron-neutron reaction $B^{10} + n^1 \rightarrow He^4 + Li^7$. On annealing, sufficient helium collected in macroscopic defects within the crystal to liquefy and produce the observed specific heat. (auth)

16812

RADIATION DAMAGE IN Ge AND Si DETECTED BY CARRIER LIFETIME CHANGES: DAMAGE THRESHOLDS. J. J. Loferski and P. Rappaport (RCA Labs., Princeton, N. J.). Phys. Rev. 111, 432-9(1958) July 15.

Minority carrier lifetime, τ, in semiconductors is shown to be more sensitive, by a factor of 10^4, to radiation-induced defects than the conductivity. Thus, in some cases, the introduction of as few as 10^{10} defects per cm^3 can be detected by its effect on τ. Both direct measurements of τ, and measurements of dependent parameters (such as the photovoltaic effect and the particle voltaic effect) are described for Si and Ge. Using such parameters, and an electron accelerator, the minimum energy needed to produce a Frenkel defect was found to be 14.5 ± 0.4 ev in Ge and 12.9 ± 0.6 ev in Si. An analysis of the phenomenon shows how the location of the radiation-induced energy levels and the relative minority carrier capture cross sections can be determined experimentally. The shape of the curve of the displacement cross section versus the incident particle energy is compared to calculations from collision theory. Qualitative explanations for the observed "tail" on this curve are presented. Calculations based on these explanations fail to yield complete agreement with the experimental curves. (auth)

Radioactivity

16813 USNRDL-TR-247

Naval Radiological Defense Lab., San Francisco.

IONIZATION-RATE AND PHOTON PULSE-RATE DECAY OF FISSION PRODUCTS FROM THE SLOW-NEUTRON FISSION OF U^{235}. Carl F. Miller and Peter Loeb. Aug. 4, 1958. 98p.

Computations giving the theoretical ionization rate and response of the AN/PDR-39(TIB) radiac at 3 feet above an infinite plane uniformly contaminated with fission products from 10^4 fissions of U^{235} per sq ft. are presented as a function of time after fission. The response of the USNRDL 4π ionization chamber and the photon pulse rate for the fission products are also presented as a function of time after fission. Disintegra-

tion-rate multipliers for each fission product nuclide per d/s of the nuclide are given; the multipliers were used to obtain the contribution of each fission product nuclide to the gross response. The theoretical ionization rate decay curve was integrated to obtain the gamma dose from the fission product mixture for various periods of time after fission. (auth)

16814

AN OPENER FOR RADIOACTIVE ISOTOPE BOTTLES. W. H. Hoather (Derbyshire Royal Infirmary, Derby, Eng.). Brit. J. Radiol. 31, 515(1958) Sept.

A simple opener is described for use in opening British-type radioisotope bottles. (C.H.)

16815

THE THEORY OF FORBIDDEN β-DECAY. G. E. Lee-Whiting (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Can. J. Phys. 36, 1199-1244(1958) Sept.

The angular distributions of electrons and of neutrinos and the polarization of the electrons emitted by an oriented source in β decay of arbitrary forbiddenness are calculated in terms of various angular-momentum coupling constants and of certain generalizations of the well-known combinations of electron radial wave-functions, L_ν, M_ν, N_ν, ... The interaction Hamiltonian used encompasses all five invariants; neither parity conservation nor time-reversal invariance is assumed A particularly simple procedure for calculating the longitudinal polarization of electrons emitted by an oriented source is pointed out. The polarization is equal to $\pm v/c$, to good approximation, if the two-component neutrino theory holds. Explicit results for various allowed and first-forbidden effects are quoted. (auth)

16816

INVENTORIED STORAGE OF LARGE NUMBERS OF SMALL RADIOACTIVE PARTICLES. L. E. Preuss (Edsel B. Ford Inst. for Medical Research, Detroit). J. Sci. Instr. 35, 307(1958) Aug.

A large number of small metal samples of radioactive tungsten, chromium, and gold have been activated in the Oak Ridge Pile. The problems of storage, records, and shielding are discussed. (A.C.)

16817

GAMMA RAYS FROM THE PROTON BOMBARDMENT OF Mg^{24}. H. E. Gove, A. E. Litherland, E. Almqvist, and D. A. Bromley (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Phys. Rev. 111, 608-15(1958) July 15.

Further measurements on the $Mg^{24}(p,\gamma)Al^{25}$ reaction at the 1.66 Mev resonance revealed a new level in Al^{25} at an excitation energy of 2.739 ± 0.010 Mev. The level decays to the ground state, the second excited state at 0.95 Mev, and the fourth excited state at 1.81 Mev in the intensity ratios $(8 \pm 6) : (63 \pm 10) : (29 \pm 14)$. This new level should correspond to a resonance at 0.47 Mev in the laboratory system. A careful search for the resonance failed to show it and an upper limit on its value of $\omega(\Gamma_p\Gamma_\gamma/\Gamma)$ is 0.6×10^{-3} ev. Revised gamma-ray branching ratios for the decay of the level corresponding to the 1.66-Mev resonance have been established. The excitation energies of the first and second excited states in Al^{25} have been measured as 0.461 ± 0.004 and 0.949 ± 0.003 Mev, respectively. The Q value for the $Mg^{24}(p,\gamma)Al^{25}$ reaction is found to be 2.287 ± 0.006 Mev. The existence of the previously reported level at 1.61 Mev in Al^{25} is confirmed as is the fact that the proton width of the 0.418-Mev resonance in the $Mg^{24}(p,\gamma)$ reaction is substantially greater than the gamma-ray width. (auth)

16818

ELECTRON POLARIZATION IN THE β-DECAY OF RaE. Wolfgang Bühring and Joachim Heintze (Univ. of Heidelberg, Germany). Phys. Rev. Letters 1, 176-7 (1958) Sept. 1.

The polarization of Bi^{210} electrons was measured using a method whereby the electrons are first deflected by multiple scattering with a thick Cu scatterer and then by single scattering at a thin Pt or Au foil. The scattering angles are 90 and 135°. The multiple scattering turns the original longitudinal polarization of the electrons into a polarization having a well defined transversal component, which in turn is measured by the azimuthal asymmetry of the single scattering. (W.D.M.)

16819

THE L/K-CAPTURE RATIO IN ^{126}I. J. Scoble and E. Gabathuler (Univ. of Glasgow). Proc. Phys. Soc. (London) 72, 437-40(1958) Sept.

A direct measurement has been made of the relative intensities of the L and K x radiations emitted in the electron capture decay of I^{126}. The source was distributed throughout the central portion of the NaI crystal in which the x radiations were measured, and coincidences were taken with the gamma rays from the excited states. The L/K-capture ratio was observed to be $0.142^{+0.005}_{-0.018}$, which is close to the theoretical value of 0.126. (auth)

Rare Earths and Rare-earth Compounds

16820

INTERPRETATION OF THE MAGNETIC PROPERTIES OF ERBIUM GARNET IN WHICH THE Al^{3+} AND Cr^{3+} IONS HAVE BEEN SUBSTITUTED FOR Fe^{3+} IONS. Gerard Villers, Jean Loriers, and René Pauthenet. Compt. rend. 247, 587-90(1958) Aug. 4. (In French)

The substitution of Fe^{3+} ions by Al^{3+} and Cr^{3+} ions in erbium garnets $5Fe_2O_3 \cdot 3Er_2O_3$ was studied. The curves relative to variations of the spontaneous magnetization and to the compensation points are interpreted by assuming that the Al^{3+} and Cr^{3+} ions occupy the 24d and 16a positions, respectively. The curie points are also given. (tr-auth)

16821

RADIOACTIVE DECAY OF Eu^{154}. S. K. Bhattacharjee, Shree Raman, and S. K. Mitra (Tata Inst. of Fundamental Research, Bombay). Proc. Indian Acad. Sci. A47, 295-309(1958) May.

The radioactive decay of Eu^{154} ($t_{1/2}$ = 16y), obtained from thermal neutron irradiations of 95% enriched Eu^{153}, was studied by using the Seigbahn-Slätis intermediate image spectrometer, a thin lens magnetic spectrometer, and a coincidence scintillation spectrometer. The following gamma-rays (energy in kev) were identified as belonging to this isotope: 123, 248, 585, 717, 759, 875, 998, 1007, 1285, 1600. Beta end points of Eu^{154} were measured at 275 (20%), 590 (45%), 890 (23%) and 1860 (12%). The K-conversion coefficient of 123 kev gamma-ray was experimentally determined to be ≈ 0.5. On the basis of gamma-gamma and beta-gamma coincidences, the decay scheme of Eu^{154} was deduced: the resulting level-structure of Gd^{154} conforms well with the predictions of the unified nuclear model. (auth)

Shielding

16822 APEX-404

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

SHIELDING COMPUTER PROGRAM 12-0 GAMMA RAY

PENETRATION POINT SOURCE. W. E. Edwards and J. J. Loechler. Aug. 1958. 22p. Contracts AF33(038)-21102 and AT(11-1)-171. $1.00(OTS).

Shielding computer program 12-0, which computes the gamma-ray flux, energy absorption rate, or dose rate from an isotropic point source, is coded for the IBM 704 computer. One frame of magnetic core memory and two tape units for utility routines are required. No magnetic-drum memory is required. (auth)

16823 ORNL-2200

Oak Ridge National Lab., Tenn.

AN ESTIMATION OF PHOTONEUTRONS FROM CARBON-13 IN AN OIL SHIELD. D. K. Trubey. Aug. 29, 1958. 19p. Contract W-7405-eng-26. $0.75 (OTS).

An expanded version of data previously published in ORNL-2081, p. 168 (Sept. 10, 1956).

Measurements of thermal-neutron flux in the presence of high-energy gamma rays in oil indicate that photoneutrons comprise a large fraction of the total thermal-neutron flux at large distances from the neutron source. This is attributed chiefly to the (γ,n) reaction in C^{13}. Measurements at the Lid Tank Shielding Facility in oil with and without a bismuth slab to reduce the gamma rays, and consequently the photoneutrons which they produced, agreed with calculated fluxes. (auth)

Spectroscopy

16824 NYO-7469

Harvard Univ., Cambridge, Mass. Mallinckrodt [Chemical] Lab.

ON KLIXBÜLL JØRGENSEN'S INTERPRETATION OF THE SPECTRA OF RHENIUM IV COMPLEXES. C. J. Ballhausen. Nov. 30, 1955. 5p. Contract AT(30-1)-1461. $1.80(ph OTS); $1.80(mf OTS).

The theoretical interpretations of the vibrational structure of some spin forbidden bands of rhenium hexachloro and hexabromo complexes by Klixbüll Jørgensen are reconsidered and shown to be very uncertain. (auth)

16825

VERSATILE MAGNETIC RESONANCE SPECTROMETER. J. A. Cowen and W. H. Tanttila (Michigan State Univ., East Lansing). Am. J. Phys. 26, 381-5(1958) Sept.

A Pound-Knight-Watkins marginal oscillator was modified by the addition of a vibrating capacitor in parallel with the tuning capacitor to produce a simple circuit which may be used to observe paramagnetic resonance at low fields, nuclear magnetic resonance, and nuclear quadrupole resonance. Suggestions are made as to the type of information which may be obtained in an undergraduate laboratory experiment. Research that can be done in smaller colleges with the instrument is discussed. (auth)

16826

ISOTOPIC SHIFT IN CERIUM AND ZIRCONIUM SPECTRA. Yu. P. Dontsov and L. A. Korostyleva. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 683-5(1958) June. (In Russian)

The isotopic shift near the magic numbers N = 50 and 82 was studied using the lines of Ce^{136}, Ce^{138}, Ce^{140}, and Ce^{142} and the 46 lines of the zirconium spectrum. The appearance of neutron jump near the magic number 50 is discussed. (R.V.J.)

16827

ISOTOPIC SHIFT IN IONIZED URANIUM SPECTRUM LINES. N. G. Morozova and G. P. Startsev. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 686-91(1958) June. (In Russian)

The isotopic shift in triply ionized uranium spectral lines was studied, and tables of experimental data showing the wave length, intensities, and isotopic shift magnitudes are presented. The mean magnitude of the shift ratio for all investigated lines $\Delta\nu_{238-235}$ $\Delta\nu_{235-233} \approx 1.77$, which is in good agreement with the data published by other authors. (R.V.J.)

16828

MEASUREMENTS OF OSCILLATION FORCES IN ATOMIC SPECTRA. 1. MEASUREMENTS OF f NUMBERS OF SPECTRAL LINES OF ATOMS WITH ADDING THE 3d SHELL. Yu. I. Ostrovskii, N. P. Penkin, and L. N. Shabanova (Zhdanov Leningrad State Univ.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 725-9(1958) June. (In Russian)

The absolute magnitudes of spectral line f numbers for Al, Ba, Ca, Ga, In, Mg, and Sr were measured. (R.V.J.)

16829

THE NEWEST SPECTRAL APPARATUS IN U.S.S.R. V. K. Prokof'ev. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 737-41(1958) June. (In Russian)

A review is given of the latest models of spectrographic equipment for visual observations, photographing, and photoelectric recording of spectra. (R.V.J.)

16830

NUCLEAR QUADRUPOLE SPECTRA OF BORON TRICHLORIDE AND TRIBROMIDE. Takehiko Chiba (Univ. of Tokyo). J. Phys. Soc. Japan 13, 860-8(1958) Aug.

The pure quadrupole resonance spectra were observed on Cl^{35} and Cl^{37} in BCl_3 and Br^{79} and B^{81} in BBr_3 at several temperatures. The spectrum of each nucleus consists of characteristic doublet (ν_I and ν_{II}) with the intensity ratio of about 3 to 5. The Zeeman study with a single crystal of BBr_3 was also carried out at liquid nitrogen temperature (77°K) to determine the asymmetry parameter η. A fair agreement was obtained between the observed separation of the doublet and the calculated one. (auth)

16831

SIMPLIFIED QUANTUM-MECHANICAL THEORY OF PRESSURE BROADENING. Michel Baranger (Carnegie Inst. of Tech., Pittsburgh and Rand Corp., Santa Monica, Calif.). Phys. Rev. 111, 481-93(1958) July 15.

Quantum mechanics is used to treat the motion of the perturbers broadening a line. Several simplifying assumptions are made, such as the Born-Oppenheimer approximation, and the assumption of no degeneracy. These assumptions can be removed. Also made is the "impact approximation," which is essential for the validity of the results and cannot be removed. With it, the line has a Lorentz shape, and its width and shift are expressed in terms of the two scattering amplitudes of the perturbers by the atom in its upper and lower state. The case where the perturbers do not interact appreciably with the lower state is particularly simple. Then, the width and shift are proportional to the imaginary part and the real part of the forward scattering amplitude, respectively. A quantity called the "collision volume" is defined. It is shown that the impact approximation is valid only if the collision volume is much smaller than the volume per perturber. There is a second validity condition, which has no classical analog. (auth)

16832

PROBLEM OF OVERLAPPING LINES IN THE THEORY OF PRESSURE BROADENING. Michel Baranger

(Carnegie Inst. of Tech., Pittsburgh and Rand Corp., Santa Monica, Calif.). Phys. Rev. 111, 494-504(1958) July 15.

The theory of pressure broadening is re-examined, in order to include the possibility of overlapping lines, which are a regular feature of pressure broadening in an ionized gas. It is found that a simple treatment can be given using the impact approximation. This approximation is examined in detail, and its validity conditions are discussed. When it is valid, it is permissible to replace the exact time-dependent interaction between the atom and the perturbers by a time-independent effective interaction. The latter is not Hermitian, however, and therefore every level acquires a width. The shape of a group of overlapping lines is then worked out, and is found to consist of a sum of Lorentz line shapes, plus some interference terms. In the particular case of an isolated line, the results given previously by Anderson are obtained. Finally, a study is made of the simplifications brought about by rotational invariance. (auth)

16833

THEORY OF LINE BROADENING IN MULTIPLET SPECTRA. A. C. Kolb (U. S. Naval Research Lab., Washington) and H. Griem (Univ. of Maryland, College Park and U. S. Naval Research Lab., Washington). Phys. Rev. 111, 514-21(1958) July 15.

A theory of line broadening in the impact approximation is developed which includes the case of overlapping lines. It is assumed that the collisions which give rise to the broadening do not cause transitions between states with different principal quantum numbers. The theory was worked out in detail in two cases: (1) the broadening arises only from perturbations of the upper state with arbitrary splitting of the substates. This approximation may be used if the perturbations of the lower state are relatively unimportant (e.g., the higher series members of the Balmer lines), and is exact if the perturbations do not affect the lower state as in the case of the ground state of hydrogen perturbed by electron collisions; (2) complete degeneracy of the initial and final states. This approximation is also valid on the far wing of the line if there is splitting, i.e., for frequencies large compared to the splitting, and is a generalization of Anderson's theory. The formal theory is worked out by two different methods. The method of calculation for nearly degenerate initial and final states with splitting is indicated. Method I is particularly suited for calculating the wing distribution while Method II is more suitable for finding the intensity distribution at the line center for overlapping lines. The line profile is made up of a sum of dispersion profiles and asymmetric terms which arise from interferences when the transition operator is not diagonal. The shift and half-width parameters are found from the roots of a secular equation and depend on the splitting as well as the density, temperature, and the character of the perturbation. (auth)

16834

AN APPARATUS FOR AUTOMATIC CONTROL OF MAGNETIC β SPECTROMETER. B. P. Peregud and K. B. Abramova (Inst. of Physics and Tech., Academy of Sciences, USSR). Pribory i tekh. Ekspt. No. 2, 12-17(1958) Mar.-Apr. (In Russian)

Descriptions are given of an apparatus for completely automatic calculation of particles passing through a β spectrometer detector per given time for twenty five magnitudes of particle energies. The calculation time at each point can be from 1 sec up to 25 min. The interval between the two closest energy magnitudes also can be widely varied depending upon the construction of the spectrometer. Particle recording is performed by 25 mechanical counters. With small alterations the apparatus can be used for automatic control of luminescence spectrometer. (tr-auth)

16835

HYPERFINE STRUCTURES OF THE RESONANCE LINES OF INDIUM 115. D. A. Jackson (Labs. de Bellevue, France). Proc. Roy. Soc. (London) A246, 344(1958) Aug. 19.

Spectroscopic measurements reported in an earlier paper are converted to vacuum wave numbers to give a true comparison with microwave measurements. (auth)

16836

RECENT ADVANCES IN NUCLEAR SPECTROSCOPY. M. H. L. Pryce (Bristol Univ., Eng.). Rend. seminar. mat. fis. Milano 27, 1-16(1957).

After a brief introduction to the problem of the theoretical interpretation of recent experimental results in nuclear spectroscopy a detailed treatment of some typical level schemes is given on the ground of the nuclear shell model, the collective nuclear model is also considered. (auth)

16837

MODULATION PICKUP IN NUCLEAR MAGNETIC RESONANCE rf SPECTROMETERS. G. B. Robinson and F. E. Geiger, Jr. (U. S. Naval Research Lab., Washington). Rev. Sci. Instr. 29, 730-1(1958) Aug.

Radio-frequency oscillators used as detectors of nuclear paramagnetic resonance absorption employ an auxiliary source at audio frequency to modulate the static magnetic field. A small component of voltage at this frequency is usually induced into the tank coil of the oscillator. If this voltage is permitted to appear at the grid of the oscillator, mixing with the rf voltage will occur. This produces a false signal indistinguishable from the resonance signal. A simple LC filter put between tank circuit and oscillator tube is found to be extremely effective in removing false resonances. The response of the oscillator to signals generated by a Watkins calibrator is measured in the range from 5 to 25 Mc. Results of these and "Q" measurements show the oscillator sensitivity to be unimpaired by the addition of the LC network. (auth)

Theoretical Physics

16838 NP-6933

Iowa State Coll., Ames. Inst. for Atomic Research. THEORY OF PARTICLES WITH ZERO REST-MASS. R. H. Good, Jr. 1958. 40p.

Recently a new point of view was found which applies to noninteracting particles of zero rest mass and which gives for them a wave equation, transformation properties, and formulas for energy, momentum, and angular momentum in remarkable parallel to Dirac's theory of the electron. Some of the details of this new point of view are presented. (auth)

16839

ON A CLASSICAL MODEL OF INDEFINITE METRIC. B. V. Medvedev and M. K. Polivanov (Joint Inst. of Nuclear Research). Doklady Akad. Nauk S.S.S.R. 121, 623-6(1958) Aug. 1. (In Russian)

The method of indefinite metric in quantum theory is elucidated by a comparable problem within the limits of classical field theory. (R.V.J.)

16840

INDICATION PROBLEMS IN PHOTON EXPERIMENTS. Balint Fogarassy (Dept. of Electromagnetic Research,

Hungarian Academy of Sciences). Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közlemenyei 5, 556-60(1957) Nov.-Dec. (In Hungarian)

Measurements carried out with an apparatus designed for studying quantum properties of a cm wavelength electromagnetic field are referred to as photon experiment. The interaction between an electron beam passing through a cavity resonator and the electromagnetic field is observed. The quantum structure of the field should be apparent by the directional scattering of the electrons leaving the cavity resonator. The effect, however, is blurred by the finite dimension of the electron beam. In the present calculation an attempt is made to find an indication method permitting an evaluation of this effect in spite of this disturbing phenomenon. (auth)

16841

EXPERIMENTAL INVESTIGATION OF THE QUANTUM STRUCTURE OF ELECTROMAGNETIC FIELDS. Pál Feit, Bálint Fogarassy, and Kálmán Tompa (Dept. of Electromagnetic Research, Hungarian Academy of Sciences). Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közlemenyei 5, 561-71(1957) Nov.-Dec. (In Hungarian)

An experiment carried out in order to obtain a direct indication of the quantum structure of a cm wavelength electromagnetic field is described. The interaction between the electromagnetic field generated in a cavity resonator and an electron beam passing through it was studied. According to the theoretical calculations on which this experiment is based the electrons leaving the cavity as a result of the interaction should have a directional scattering of given value. In the experiment, however, no directional scattering was observed or more precisely if there were any directional scattering it was not more than 10% of the expected value. (auth)

16842

EFFECTS RELATED TO NONCONSERVATION OF PARITY IN β DECAY. V. B. Berestetsky, B. L. Ioffe, A. P. Rudik, and K. A. Ter-Martirosyan (Dept. of Physical-Mathematic Sciences, U.S.S.R. Academy of Sciences, Moscow). Phys. Rev. 111, 522-31(1958) July 15.

Angular distributions and polarization of β particles are considered on the basis of the most general assumption possible regarding the form of the interaction operator, including effects due to Coulomb field and finiteness of nuclear dimensions. Results are obtained for allowed transitions, first-order forbidden transitions in intermediate and heavy nuclei (Coulomb transitions), unique transitions [$\Delta j = 2$ (yes)], and $0 \rightarrow 0$ (yes) transitions. (auth)

16843

VELOCITY-DEPENDENT FEATURES OF A STATIC NUCLEON-NUCLEON POTENTIAL. G. Breit (Yale Univ., New Haven, Conn.). Phys. Rev. 111, 652-63 (1958) July 15.

The consequences of assuming a pseudoscalar classical field with pseudoscalar coupling are considered in a static approximation. Virtual pair formation of nucleon-antinucleon pairs is not calculated but it is supposed that it gives rise to an attraction. The interaction is being studied mainly in order to see what features of commonly assumed static potentials may not apply. The quantitative features of the derived interaction are not expected to correspond to the physical one. The qualitative character of deviations from static potential behavior is believed, however, to have a bearing on the velocity-dependent features of the actual interaction. The work neglects some of the effects of the exclusion principle caused by the population of negative-energy states. Some of the qualitative nonstatic features are: (a) different magnitudes of the spin-orbit potential in even and odd states, (b) inadequacy of the usual procedure of the insertion of e^2/r in the wave equation for the calculation of phase shifts in p-p scattering; this inadequacy is connected with the fact that the standard form of the wave equation is obtained only after a transformation of a wave equation in which e^2/r has a direct significance as a potential energy, (c) velocity (energy) dependence of core radii and of magnitude of effective potentials, (d) occurrence of quadratic term in the tensor interaction in the effective potential even though in an earlier stage of the calculation only linear terms are present. (auth)

16844

THEORETICAL SURVEY OF β-DECAY AND μ-DECAY. D. L. Pursey (Univ. of Edinburgh). Proc. Roy. Soc. (London) A246, 444-53(1958) Aug. 26.

The theory of β-decay and μ-decay is reviewed to give a background to the answers sought in experimental work. The neutrino theory of Weyl is discussed. (W.D.M.)

16845

QUANTUM ELECTRODYNAMICS WITH THE INDEFINITE METRIC. Sigenobu Sunakawa (Osaka Univ.). Progr. Theoret. Phys. (Kyoto) 19, 221-37(1958) Mar.

Gupta's quantum electrodynamics was investigated in several kinds of representation, and it was shown that the Gupta metric operator for the free field can be used even in the case of interacting fields. It was also shown that the Gupta theory is not invariant under the Lorentz transformation. (auth)

16846

AN ATTEMPT OF A NONLINEAR FIELD THEORY. Hideji Kita (Kyoto Univ.). Phys. Theoret. Phys. (Kyoto) 19, 454-6(1958) Apr.

A new unified field theory is proposed. It is assumed that there exists only a basic spinor field $\Psi(x)$ which satisfies the nonlinear equation, $\gamma^{\mu}(\partial/\partial X_{\mu} - \Gamma_{\mu})\Psi = 0$, where matrix-functions $\gamma^{\mu}(x)$ and $\Gamma_{\mu}(x)$ are certain functions of Ψ. It is further required that the equation should be invariant under general coördinate transformations. (W.D.M.)

16847

POLARIZATION PROPERTIES OF CHERENKOV RADIATION. Yu. M. Loskutov. (Dept. of Statistical Physics and Mechanics.) Vestnik Moskov. Univ. 12, No. 5, 101-4(1957). (In Russian)

The influence of particle spin on the polarization of emitted radiation was studied in relation to some particle properties. Calculations of radiation intensity were made for linear and circular polarizations. (R.V.J.)

16848

INTERACTION BETWEEN ELECTRONS AND THE LATTICE VIBRATIONS IN A NORMAL METAL. A. B. Migdal (Moscow Inst. of Engineering Physics). Zhur. Eksptl'. i Teoret. Fiz. 34, 1438-46(1958) June. (In Russian)

A method is developed which permits one to find the electron energy spectrum and dispersion of the lattice vibrations without assuming the interaction between the electrons and phonons to be small. (tr-auth)

16849

ON THE THEORY OF PARTICLES WITH HIGHER SPINS. L. A. Shelepin (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 1574-86(1958) June. (In Russian)

An algebraic method for investigating the relativistically invariant equations for particles with higher spins is proposed. The direct product of the generalized Dirac algebras underlies the analysis. The method permits one to determine in an explicit form the matrices of an infinitesimally small rotation, spin, metric, and reflection and also to restrict the number of representations under consideration. The equations can be investigated directly either in the tensor or spin-tensor form. Commutation relations in a parametric form are obtained automatically. (tr-auth)

16850

PERIODIC SOLUTION OF THE NONLINEAR GENERALIZED DIRAC EQUATION. D. F. Kurdgelaidze (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 34, 1587-92 (1958) June. (In Russian)

The nonlinear Dirac equation is considered and a method for its solution is proposed. Periodic solutions in the general form are obtained. A relation between the nonlinear Dirac equation and Klein–Gordon equation is established. (tr-auth)

16851

APPROXIMATION FOR THOMAS-FERMI FUNCTION. D. G. Sannikov (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 1650-1(1958) June. (In Russian)

A new function where I is closer to the minimum magnitude and equals 1.3624 is written for the approximation of the Thomas-Fermi equation. (R.V.J.)

16852

SCATTERING ON SCHWARZSCHIELD FIELD IN QUANTUM THEORY. N. V. Mitskevich (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 34, 1656-8(1958) June. (In Russian)

Uranium and Uranium Compounds

16853 LAMS-2226

Los Alamos Scientific Lab., N. Mex.

ON THE PRODUCTION OF HEAVY URANIUM ISOTOPES IN A VERY HIGH DENSITY FAST NEUTRON FLUX. Joseph J. Devaney, Albert G. Petschek, and Mary Tsingou Menzel. May 1958. 17p. Contract W-7405-Eng-36. $0.75(OTS).

An estimate of the probability of multiple capture of neutrons by U^{238} in times short compared to β-decay lifetimes and to spontaneous fission lifetimes as, for example, in a thermonuclear explosion is discussed. It is assumed that the requisite very high density neutron flux is present. How far successive capture can go is sought. The pertinent cross sections are estimated and appropriate differential equations are set up and solved. Estimates are given in the form of graphs. (T.R.H.)

16854 WAPD-200

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

AN IN-PILE MEASUREMENT OF THE EFFECTIVE THERMAL CONDUCTIVITY OF UO_2. J. D. Eichenberg. Sept. 1958. 12p. Contract AT-11-1-GEN-14. $0.50 (OTS).

An experiment was designed to measure the "effective" thermal conductivity of UO_2 during irradiation. A description of the experiment and the available results are presented. Although the results are subject to a number of limitations, it is felt that the trend in the values is significant, and that a value of 0.85 Btu/hr-ft-°F for the mean "effective" thermal conductivity of a helium-filled UO_2 fuel rod with 0.0035-in. as-assembled diametral clearance is an appropriate value for use in calculating the thermal performance of such fuel rods. (auth)

16855 NP-tr-126

THE EMISSION AND ABSORPTION SPECTRUM OF URANIUM. N. P. Penkin and S. E. Frish. Translated by L. Bovey (U.K.A.E.A. Atomic Energy Research Establishment) from Optika i Spektroskopiya 3, 473-9 (1957). 5p. (Tables omitted).

The emission and absorption spectra of uranium excited in a King vacuum furnace at temperatures from 2800 to 3000°K were studied. One hundred sixty seven emission and forty seven absorption lines were observed, and it is pointed out that the results are in general agreement with the published classification and the lowest level is $^5L_6^0$. (J.R.D.)

16856

THE STRUCTURE OF U_3O_8 DETERMINED BY NEUTRON DIFFRACTION. Arne F. Andresen (Joint Establishment for Nuclear Energy Research, Kjeller, Norway). Acta Cryst. 11, 612-14(1958) Sept.

Neutron diffraction diagrams of the orthorhombic form of U_3O_8 show that the structure previously assumed on the basis of x-ray data must be in error. A modified unit cell is derived in which two of the uranium atoms are surrounded by a distorted octahedron of six oxygen atoms at distances of $U_1-O_2 = 2.07$ A and $U_1-O_4 = 2.18$ A. The other four are surrounded by seven oxygen atoms at distances $U_2-O_3 = 2.07$ A, $U_2-O_1 = 2.21$ A, $U_2-O_4' = 2.17$ A, and $U_2-O_4'' = 2.42$ A. The symmetry conforms with the orthorhombic space group D_2^6-C222. (auth)

16857

THE DISTRIBUTION OF SPONTANEOUS FISSION EVENTS IN U^{238} OVER FRAGMENT ENERGY. B. S. Kovrigin and K. A. Petrzhak. Atomnaya Energ. 4, 547-54(1958) June. (In Russian)

Records were made of 780 spontaneous fission events of U^{238} and 4500 events of U^{235} fission by slow neutrons. The data were used for plotting the statistical distribution of the events over the fragment energy. The following curves were developed for both fission events: the energy spectra for all fragments and separately for the light and heavy fragments; the distribution of events by the total kinetic energy for both fragments of the nucleus; distribution of fission fragments by masses; the dependence of the total mean kinetic energy of light and heavy fragments on their total kinetic energy. Results for both isotopes show great resemblance. It was revealed that the total kinetic energy of the two fragments in U^{238} spontaneous fission is about 4 Mev less than that for U^{235} thermal fission. (tr-auth)

16858

RECRYSTALLIZATION IN URANIUM CAUSED BY THERMAL CYCLING. A. A. Bochvar, G. I. Tomson, and N. T. Chebotarev. Atomnaya Energ. 4, 555-6(1958) June. (In Russian)

Recrystallization which results in crushed initial microstructure was observed as the result of cyclic thermal treatment at temperatures of 100 to 550°C for 50 sec in quenched and tempered γ phases and in cast uranium not subjected to additional deformation. Recrystallization starts at the points with the most distorted crystalline lattice. (tr-auth)

16859

ORIENTATION RELATIONS BETWEEN RECRYSTALLIZATION CRYSTALS AND DEFORMATION BANDS IN α URANIUM. Daniel Calais, Nicole Mandin, and Paul

Lacombe. Compt. rend. 247, 646-9(1958) Aug. 11. (In French)

Monocrystals of α uranium with certain orientations give rise to deformation bands after traction. After annealing, they lead to recrystallization crystals in which the orientation relations with the mother crystal are conditioned by the crystallography of the deformation method. (tr-auth)

16860

X-RAY DIFFRACTION INVESTIGATION OF NATURAL URANIUM OXIDES. I. ALTERATION OF THE SIZE OF THE ELEMENTARY CELL OF NATURAL URANIUM OXIDE. G. A. Sidorenko. Geokhimiya No. 1, 22-38(1958).

Natural uranium(IV) oxide crystallizes in the fluorite lattice. Lead occurs from the decay of uranium, and the residual uranium is gradually oxidized to ±U(VI). No phase transformation occurs, however, as in synthetic oxides. The lattice constant is reduced. A number of uraninites were investigated by the Debye-Scherrer method, spectrochemically, and microanalytically. The results showed that the oxygen coefficient is a function of the lattice constant. Oxidized pitchblende gives diffused diffraction patterns which could be caused either by the small size of the particles or by a distorted lattice structure. The phase transformation caused by heating the oxide crystal was investigated between 300 and 1000°C. The lattice constants for the different phases are tabulated. (J.S.R.)

16861

THE ATOMIC AND ELECTRON HEAT OF URANIUM BETWEEN 10°K AND ROOM TEMPERATURE. K. Clusius and U. Piesbergen (Physikalisch-Chemisches Institut der Universität, Zürich). Helv. Phys. Acta 31, 302-3(1958). (In German)

The atomic heat of uranium was measured between 10°K and room temperature. Up to 11°K the conversion from C_p to C_v follows the relation $C_p - C_v = 2.08 \times 10^{-5} C_p^2 T$. Beyond 18°K the values measured lie on a straight line in a C_v/T, T^2 diagram. Beyond 100°K the Debye θ value falls rapidly to zero. (J.S.R.)

16862

FISSION OF URANIUM NUCLEI AND FORMATION OF MULTICHARGED FRAGMENTS FROM PHOTOGRAPHIC EMULSION NUCLEI INDUCED BY HIGH ENERGY π^+-MESONS. N. S. Ivanova (Radium Inst., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 1381-8(1958) June. (In Russian)

The interaction between 280 Mev π^+ mesons and uranium nuclei accompanied by fission was studied with nuclear emulsions. The analysis of light charged particles emitted in fission showed that π^+ meson absorption predominantly occurs in the interaction involving a pair of nucleons (n, p). The main features of uranium fission induced by high energy π^+ mesons are investigated. Some peculiarities of production of multicharged ($Z \geq 4$) fragments from the emulsion nuclei induced by high energy positive π-mesons are noted. The cross section for production of such fragments on heavy emulsion nuclei (Ag, Br) is estimated. (tr-auth)

PERSONAL AUTHOR INDEX

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